Western Engineering

VOL. 4 SAN FRANCISCO, JUNE, 1914 NO. 6

PUBLISHED MONTHLY BY THE WESTERN ENGINEERING PUBLISHING CO. AT 420 MARKET STREET, SAN FRANCISCO.

Entered as second-class matter, June 1, 1912, at the post-office at San Francisco, California, under Act of March 3, 1879

Telephone Kearny 4777. Cable Address: Pertusola. Code: Bedford McNeill (2 editions).

BRANCH OFFICES:

CHICAGO—734 Monadnock Building NEW YORK—Woolworth Building
LONDON—The Mining Magazine, Salisbury House, E.C.

ANNUAL SUBSCRIPTION:

United States and Possessions, and Mexico $3
Other Countries in Postal Union 4

CHARLES T. HUTCHINSON, Editor H. L. QUIGLEY, Advertising Manager

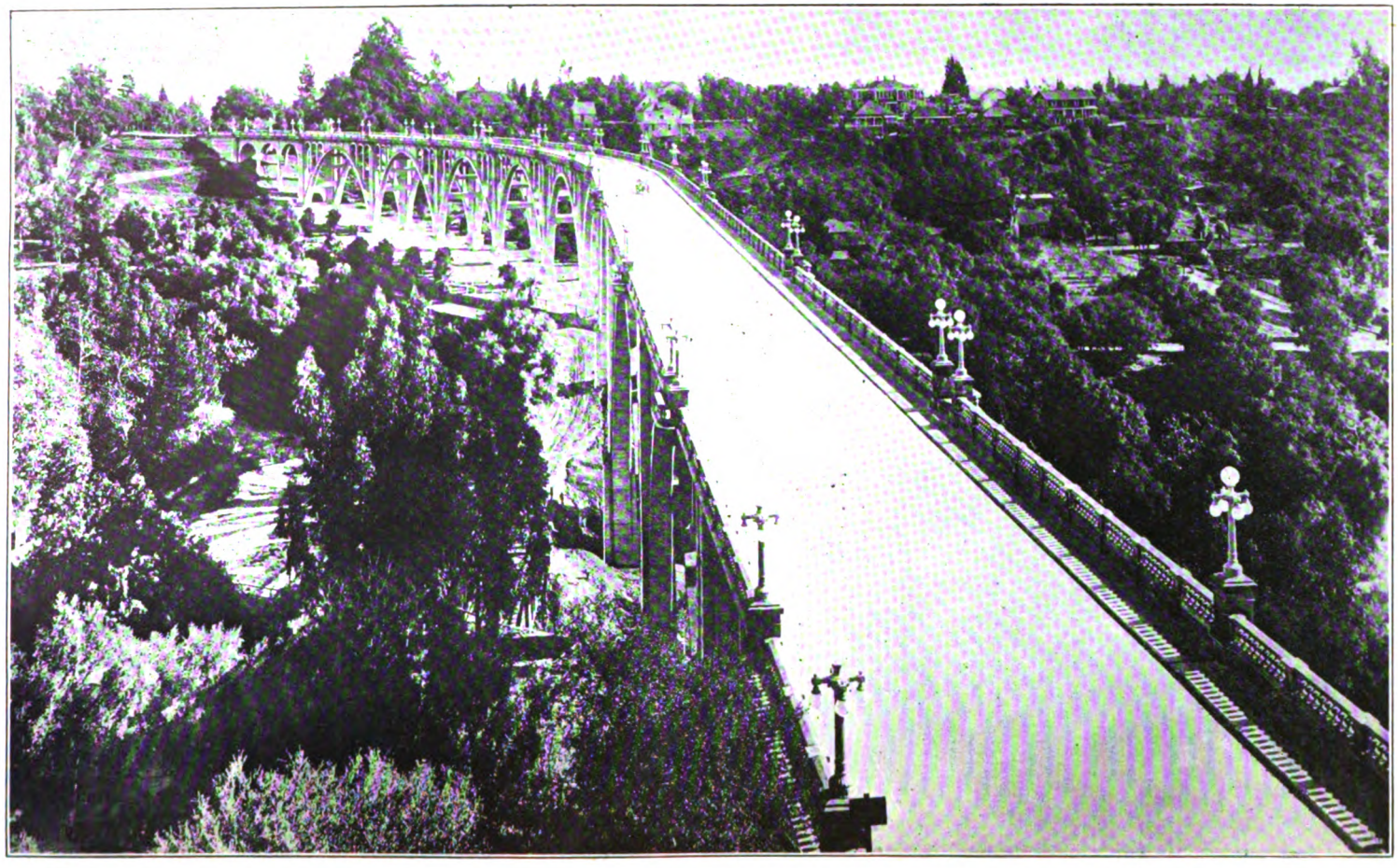
TABLE OF CONTENTS

EDITORIAL: Page.
Notes 407
Quantity Estimating 409
REVIEW OF THE MONTH 411
ARTICLES:
Big Creek Hydro-Electric Power Development ..... *Walter E. Jessup* 415
Pier Twenty-Eight, San Francisco ..... *Frank G. White* 428
Creosoting Douglas Fir ..... *M. J. Falkenburg* 438
Effects of Faulting in Oilfields ..... *Dorsey Hager* 442
Pumping Plant for Reclamation District No. 1500 446
The Compressed Air Method of Mixing and Placing Concrete 454
Colorado Street Bridge, Pasadena, Cal. ..... *J. C. Wright* 456
Summary of All Known Concrete Roads and Streets in the United States ..... *George D. Steel* 461
THE ENGINEERING DIGEST:
Concrete Road Crossing a Flood Plain 462
Reinforcing Decayed Poles ..... *A. J. Purinton* 464
International Engineering Congress, 1915 464
Road Conditions in 100 Counties 465
A Two-Form Report of Progress ..... *Lindon Bates, Jr.* 466
ENGINEER'S NOTE BOOK:
Street and Sewer Construction at Spokane, Wash. 469
Diagram of Cost of Retaining Walls ..... *E. F. Kriegsman* 469
BOOK REVIEWS 470
COMPANY REPORTS 472
INDUSTRIAL PROGRESS:
Engine-Driven Continuous Current Generators of the Commutating Pole Type ... 473
HINTS ON PRACTICE:
Simple Sidewalk Construction 475
The Farmer and the Road Problem 477
ENGINEERING NEWS 479
PERSONAL 483
CATALOGUES RECEIVED 484

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Generated on 2024-09-30 00:39 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google

Digitized by Google



THE COLORADO STREET BRIDGE OVER ARROYO SECO, NEAR PASADENA, CALIFORNIA. (See page 456).

Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

EDITORIAL

RESIDENTS of New York, Chicago, and other densely populated districts will be interested in learning that more commuters travel daily across San Francisco bay than over any similar body of water in the world. During 1913 no less than 40,426,014 passengers were carried between San Francisco and the outlying commuter districts, which is a gain over the number carried in 1912 of 1,474,991.

BREAKING ground for the first machinery exhibit at the Panama-Pacific Exposition took place on May 27. It seems appropriate that this exhibit should consist of a 500-horse-power Diesel Stationary Engine, the latest type of prime mover. The exhibit is to be made by the Busch-Sulzer Brothers Diesel Engine Company, St. Louis. Engineers will have an opportunity of seeing this engine in operation on California oils during the period of the Fair.

LOS ANGELES has again expressed its approval of municipal ownership of public utilities by voting for a $6,500,000 bond issue to provide funds for an electric power distribution system. This is a direct consequence of the aqueduct water supply enterprise and is intended to supply the city with a means of marketing the power developed incidental to the domestic water supply. It is believed that the city will condemn the system owned by the Southern California Edison Company rather than install a system of its own and enter into competition for business with privately owned companies.

A DECISION rendered in the Superior Court at San Bernardino recently is of vital interest to all holders of irrigation bonds. The decision upholds the constitutionality of the section of the Irrigation Act directing boards of supervisors to make tax levees against irrigation districts which refuse to pay the judgments of courts in favor of bondholders. The case in point refers particularly to a suit by the Riverside County Board of Supervisors against the Perris irrigation district. Had the decision been to the contrary, the only method by which irrigation bondholders could enforce collection of the principal and interest would have been removed.

THE following from the Fresno *Herald* dated Sanger, California, February 3 is of interest: "An intricate infernal machine which, if loaded with nitroglycerine and discharged, could have done inestimable damage, was found in the flotsam deposited near this city by the recent flood. The machine consists of a clocklike arrangement attached to a brass cylinder. It is inclosed in a glass case. This instrument of destruction is now in the hands of Constable Campbell and will be turned over to Government officials." This dangerous instrument is a Friez automatic river gauge which has been faithfully recording the ups and downs of Kings river for nearly 11 years for the United States Geological Survey. The recent flood exceeded by six feet the maximum recorded stage for the past 18 years and swept the gauge away from its moorings.

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

WHILE many rival steamship lines, transportation companies, and individuals are vying with one another for the honor and incidental advertising that will accrue to the first vessel to make the passage through the Panama canal from ocean to ocean, it is a matter of fact that vessels have for some time been quietly making the trip without flourish of trumpets or ceremonial of any kind. The first passage of a self-propelled vessel occurred on Wednesday, January 7. The crane-boat *Alexander La Valley* made the passage from the Atlantic entrance through Culebra cut, Pedro Miguel, and Miraflores locks to the Pacific entrance. No passengers were carried, only the regular crew being allowed on the vessel.

ENGINEERS on the Pacific Coast will be interested in learning that piles driven in the Great Salt Lake for a railroad trestle have been inspected and found perfectly sound after 43 years of service. The piles in question were only of local pine and fir and during the long period of their immersion have become impregnated with salt. Salt as a timber preservative is apparently a new idea. It is learned, however, that telephone and electric companies in the Salt Lake valley have been using the local salt as a preservative. When set up, about 75 pounds of salt is placed around the pole in the ground. This method, however, cannot be used when the pole is on or near a lawn or any place where vegetation is desired. This method of preservation, however, is not offered in any sense as a proof against the attack of teredos, limnoria, or any other marine borers, but as a means of preservation against ordinary decay when exposed to air or moisture in the ground. It has been suggested that timbers after treatment with saturated salt solution, of which the Great Salt Lake is composed, shall be treated with a paint coat of creosote which will serve to keep out the moisture and keep in the salt.

PREPARATIONS are well under way for the International Engineering Congress to be held during the Panama-Pacific Exposition in 1915. The committee of management has nearly concluded its arrangements with various engineers, eminent in their profession, for the preparation of papers within the field to be covered by the Congress. The papers in general will be of such a character as to give a summarized view of the status and tendencies in the various lines of engineering activities of the world, rather than papers presenting individual instances of engineering works, or those treating special engineering problems and research work. It is believed that papers summarizing past progress, and present status, will be of the greatest possible value as a fitting commentary of the labors of the engineering world. Judging by the response that has been made to the committee thus far, this Congress will be the most notable gathering of engineers that has yet taken place and will undoubtedly prove to be of incalculable benefit to those who participate in its activities.

INTERESTING details have come to hand with respect to the initial trip of the Diesel motor vessel *Warrior*, the first of its kind to be built on the Pacific coast. The *Warrior* is owned by the Pacific American Fisheries and is doing service as a cannery tender. The initial voyage covered the distance from Bellingham to Ketchikan, 590 nautical miles. The actual traveling

Generated on 2024-09-30 00:35 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

time was 59 hours at an average speed of 10 knots per hour. The fuel cost for this voyage is stated to have been $10.50, the fuel being known as 'Star' oil, manufactured by the Standard Oil Company. The *Warrior* is a 97½-ton vessel, 87 feet long, 17-foot beam, 7 feet 4½ inches draft, and is fitted with a 120-horse-power NLSECO Diesel engine. The fuel capacity is 1400 gallons of Star oil which costs, in Seattle, $1.15 per barrel of 42 gallons. On the boat's trials, the fuel consumption was 6¼ gallons of oil per hour, which gives the vessel a cruising radius of 224 hours or approximately 2655 miles at a total cost for fuel of $38.50 or about 1¾ cents per mile. It has been generally conceded that the marine field is exceptionally promising for the application of the Diesel engine, and it would appear from the above that this holds good as well for smaller vessels as for large ocean-going freight and passenger carriers.

THE city of Los Angeles for the past year seems to have derived a great deal of entertainment by playing football with the Midway Gas Company, the latter having occupied the position of the ball. When this enterprise was conceived, the first snag that the Company ran up against seems to have been the newspapers. The editorial molders of public opinion in the South decided that the rate to consumers for natural gas should not be more than 30 cents. They also decided that it was a pernicious practice to mix the natural gas and the manufactured product. The California Railroad Commission then took a hand in the game and decided that a wholesale rate of 14 cents per 1000 cubic feet was sufficient to provide a reasonable profit to the Company and also amortize the capital investment within ten years. As it happens, however, manufactured gas which is made from California crude oil has a calorific value of about 600 British thermal units, while the natural product averages about 1000 British thermal units. The result was that the consumers, even with the blended product, obtained a gas so much higher in heat value than the manufactured product that it was only necessary to burn about one-half as much as they had been in the habit of using. It is hard enough to have your revenue per unit curtailed, but when the number of units is also cut nearly in half it seems like adding insult to injury. Now it is expected that the authorities of Los Angeles will impose an arbitrary rate for retail consumers of 40 cents, which is about half as much as the rate for the manufactured product. With 1000 British thermal unit gas at 40 cents, compared to 600 British thermal unit gas at 75 cents, it would appear that capital has fallen upon hard times indeed. The Midway Gas Company, however, does not seem disposed to submit to a state of affairs which they claim will make their enterprise unprofitable. The Company proposes first to increase its capital stock from $3,000,000 to $6,000,000 in order to provide funds for acquiring the compressor plant, gathering lines, wells, and production rights from the Southern California Gas Company, and also to provide funds that will enable it to divert its gas supply elsewhere in case the rates fixed by the city of Los Angeles should not provide sufficient revenue to make the enterprise a financial success.

Quantity Estimating

The road to success, under the best of circumstances, is stony and bestrewn with pitfalls. There are but few sinecures nowadays; in fact, even inher-

Generated on 2024-09-30 00:30 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

iting money is made less desirable by the activities of the government in taking for itself a slice of the unearned increment. But of all pursuits, the way of the contractor is as hard as any and harder than most. The idlers on the street, whose sole occupation in life seems to consist of watching men at work, may be found to congregate in largest numbers where a modern skyscraper is going up, a track gang is creating a new railroad, or wherever some contractor has undertaken to make something for somebody in less time and for less money than would any other. There is no better example of 'free and open' competition than may be found in contracting. And perhaps that is not the least of the causes contributing to the high financial mortality among contractors. When bids are opened and a contract awarded, one may instantly select the successful bidder from among those present by the lugubrious cast of his countenance. He would give much at that time to be able to recall his bid long enough to check his figures and see if some mistakes have not been made. At this juncture one may of course give vent to the usual platitudes about making mistakes, but though we all recognize the obvious disadvantage of making mistakes and the inevitable penalty therefor, we go on making them just the same, and will undoubtedly continue to do so. The most frequent source of error in contract estimating is in the determination of quantities, and for the same reason, it is in this respect that the contractor himself often falls down. It is to correct this condition as far as possible that the quantity system of estimating is now being advocated with renewed vigor. This system is not a new idea, but has been more or less under discussion among architects, engineers, and contractors since 1891. Perhaps the best presentation of the subject that has yet appeared is a paper delivered by Mr. G. Alexander Wright before the Technical Society of the Pacific Coast on March 6, 1914, and published in the Journal of the Association of Engineering Societies for April, 1914. Mr. Wright designates present day competitive conditions as largely gambling as far as any accurate determination of quantities is concerned, and gambling it is, no more, no less. It is admitted that the more capable and careful a bidder is, the less his chance for securing a contract. The function of the quantity surveyor is to remedy this condition. He is an independent person specially trained for this kind of work. As the name indicates, he prepares accurate estimates on all quantities, these data being furnished to contractors as an essential part of the plans and specifications. Thus all contractors are placed upon an even footing, unit prices may be determined from the bids and may be used as a basis for adjustment in case the actual quantities proved to have been required after the job has been finished shall be more or less than those estimated. The quantity surveyor is paid by the owner as is the architect and the engineer. It requires but little thought to see the immense advantage to all concerned that would immediately follow the adoption of some such plan as this. In order to place the system in operation it is recommended that the United States Government and every state and county in the Union shall furnish free of cost to every bidder detail bills of quantities, setting forth clearly and squarely exactly what quantity and nature of work each bidder will be required to perform. It is expected that the municipalities will follow this practice and that the next step will be to enlist the support of private owners.

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

REVIEW OF THE MONTH

ACCORDING to press reports, President Wilson has designated the present business stagnation as psychological, and has stated that there will be no halt in the Administration 'trust-busting' program. Disclosures such as those recently made by Mr. Mellen before the Congressional Investigation Committee with reference to the administration of the New York, New Haven & Hartford Railroad affairs have not contributed to a restoration of confidence in 'big business.' Just how 'big business' will go about it to obtain a return of confidence in themselves is a puzzle. In the minds of the people, all are tarred with the same brush, which, as a matter of fact, imposes a grave injustice upon the great majority of our business enterprises.

THE process of recovery from the long succession of shocks to which the business structure has been subjected is going to be slow and painful, especially the latter. The engineer has suffered more than most people. Retainers are scarce and payment for service even scarcer. Professionally trained men are drifting into all sorts of employment, anything in fact that connects with a pay-check once a month. Just as local financial affairs seemed about to settle down to a normal basis the new broom wielded by the management of the United Railroads has disclosed another pile of rubbish concealed in a corner. The rubbish in question is in the form of a personal note for $1,096,000, signed by Mr. Patrick Calhoun, formerly president of the Company. This note has been valued by Mr. Jesse Lilienthal, who is now president of the Company, at $1. The existence of this note was made public at a hearing before the Railroad Commission, at which a request from the United Railroads for authorization to enter into a trust agreement with E. H. Rollins & Sons for the purchase of 65 additional cars was under consideration. Expert accountants for the Railroad Commission discovered a diversion of this amount of money when going over the Company's books for the months of March, April, May, June, and July, 1913. In the opinion of Mr. Edgerton, Mr. Calhoun diverted this amount into an investment in the Solano Irrigated Farms pursuant to a resolution of the board of directors dated August 21, 1912, in which Mr. Calhoun is authorized to draw such sums and make such disbursements and advances of the Company's funds as he may see fit for the benefit of the Company.

THE report of Mr. Edgerton states in effect that while no proof was made to the Commission that any part of this money was actually invested in the so-called Solano project, the money was taken by Mr. Calhoun under the authority of the board of directors and ratified by the stockholders, and when Mr. Lilienthal took office as president, Mr. Calhoun was forced to execute a promissory note for the amount payable one day after date in favor of the Company and secured by stock in the Solano project. The Railroad Commission found it difficult to reconcile the fact that at a time when a sum of money in excess of $1,000,000 was diverted from the Company's treasury,

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

this same Company was urging upon the Commission the necessity for issuing further bonds to pay off maturing obligations, and also at a time when the outstanding obligations admittedly could not be paid at maturity by approximately $20,000,000. The Commission's opinion is expressed in the following quotation from the published report: "The whole transaction is a fraud not only upon the public, which is dependent upon this utility for its street-car service, but also upon the bond and note holders of this utility, because to the extent that money is diverted to improper purposes these creditors are defrauded."

FOLLOWING the decision of the State Supreme Court with relation to the franchise granted to the Oro Electric Corporation to operate within the city of Stockton and discussed in the Review section of our May issue, a re-hearing has been granted to the Railroad Commission. In the petition for a re-hearing, the Railroad Commission has been joined by a number of the largest public utilities power corporations, among them the Pacific Gas & Electric Company, the Western States Gas & Electric Company, which now enjoys a monopoly in Stockton, and the Southern California Edison Company. It is recognized that the decision of the Supreme Court in the Oro Electric Corporation case threatens to destroy the fundamental principles upon which the public utilities act is based. This principle may be summed up in the doctrine laid down by the Commission that no public utilities corporation would be allowed to enter in a field in which another similar corporation was already established and giving adequate and satisfactory service. The Commission, in denying to the Oro Electric Corporation a certificate of public necessity and convenience, held that the service furnished by the Western States Gas & Electric Company was adequate and satisfactory. The Supreme Court, however, without entering into this phase of the case decided that as the city had granted a franchise to the Oro Electric Corporation, and had not delegated these powers to the California Railroad Commission, the Commission had no authority to deny the Oro Electric Corporation the privilege of exercising the rights granted under the franchise. Mr. Charles P. Cutten, attorney for the Pacific Gas & Electric Company, has stated in effect that if rates are to be cut down by the Commission and regulation carried to the point of fixing a certain rate of revenue, then the regulated companies must be protected in their fields of competition. It would appear to be obvious that the right to regulate must carry with it an obligation to protect. If a court should decide that the public utilities act is inoperative where cities and towns are concerned unless the cities have voluntarily placed the control of their public utilities in the hands of the Commission, then it would appear to a layman that the whole structure growing out of the public utilities act of California is going to fall by the wayside. At best the situation is difficult and the final decision, whatever it may be, will be of far-reaching effect to all public utilities corporations within this state.

ANOTHER equally important act is about to undergo the judicial test. A petition for a writ of review for the purpose of testing the constitutionality of the act under which the State Industrial Accident Commission was created has been filed in the Supreme Court by the Great Western Power Company. In October 1913 an employee of the

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Company was killed while cutting a live wire of the Company's lines without rubber gloves which his foreman had ordered him to wear. The State Industrial Accident Commission rendered an award to the heirs of the victim in this case and denied the Company a re-hearing in the matter. A question of procedure has appeared with respect to the accident which arose under the Roseberry act while the award was made by a commission created by the Boynton act. The Company takes the ground that the Supreme Court should grant the petition for a review because the Boynton act creating the State Accident Commission is unconstitutional in that it deprives persons of their property without due process of law, that it is class legislation in that it exempts persons engaged in farming or stock-raising, and that the State Accident Commission exceeded its jurisdiction in making the award.

WORD has been received from Washington that the Church bill dealing with the disposal of unpatented oil and gas lands in the state of California and other states has been unanimously and favorably reported by the House Public Lands Committee. According to press reports, the principal provisions of the bill are: "That upon relinquishment or surrender to the United States, within six months from the date of the act, by any locator or his successors in interest, to unpatented oil or gas had been discovered, or upon which drilling operations were in actual progress January 1, 1914, and the claim to which land was initiated prior to July 3, 1910, the Secretary of the Interior may lease to such locator or his successors in interest the said lands so relinquished, not exceeding, however, the maximum area of 640 acres to any one person, association, or corporation, said leases to be conditioned upon the payment by the lessee of a royalty of not exceeding one-eighth of the oil or gas extracted or produced from the leased premises or the proceeds thereof, each lease to be for a period of twenty years, with the preferential right in the lessee to renew the same for succeeding periods of ten years, upon such reasonable terms and conditions as may be prescribed by the Secretary of the Interior. The Secretary of the Interior is authorized to make such rules and regulations as he may deem necessary for carrying the provisions of the act into effect, and all leases or assignments of leases shall be subject to such rules and regulations, and the failure of any lessee or of his successor or successors to comply with the terms and conditions of the lease shall work a forfeiture of the same, to be declared by a court of competent jurisdiction." As originally drawn the bill provided for leases of 2560 acres, but the committee changed this to 640 acres before reporting it.

NEWS that the San Francisco-Oakland Terminal Railways has financed its contemplated improvements is most welcome. An application for permission to issue $10,000,000 in bonds has been filed with the Railroad Commission. Of this amount $4,600,000 will be used to pay off outstanding obligations and the balance for the purchase of new street-cars, additional ferry boats, completion of the new Key Route pier, and other betterments. The statement in detail as to the immediate expenditures is as follows: Track reconstruction, $400,000; construction proportion of necessary improvements to present track and pavement, $160,000; additional curves, turn-outs, etc., for increased service, $30,000; improve-

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

ments and additions to overhead trolley system, $5000; additional feeder lines, $10,000; purchase of fifty new traction cars, $325,000; purchase of two new ferry-boats, $600,000; remodeling present rolling stock, $105,000; purchase and installation of additional electrical equipment for present rolling stock, $115,000; paving plant and equipment, tools, etc., $40,000; additional shop machinery and tools, $10,000; construction of office building, $50,000; pier fill and construction of new pier and pier terminal and ferry slip; total cost $2,400,000; available cash, $1,000,000; additional cash required, $240,000. The total amount to be expended immediately is $2,100,000.

ANOTHER indication of the increasing tendency on the part of financiers to issue prior preference stock as a form of security instead of the customary bonds is shown by an announcement issued to the stockholders of the San Joaquin Light & Power Company. The Company has called a special meeting of stockholders to take place on June 11 for the purpose of authorizing an amendment to the articles of incorporation by changing the $3,500,000 of unissued preferred stock into 6 per cent cumulative prior preferred stock. This will have preference over the existing preferred and common stock, both with regard to payment of dividends and principal. The unfavorable financial conditions existing during the last two years have prevented the sale of bonds at a satisfactory figure. Consequently short term notes were used to provide working capital and secured by $4000 of bonds for each $3000 of notes issued. The funds to be derived from the sale of this stock will be used for providing a working capital fund and for such a proportion of the cost of improvements and betterments as can be provided for through the issue and sale of the corporation's first and refunding bonds.

A DECISION affecting the status of disputed oil lands in California has just been handed down by the United States District Court in the Southern California district. The decision in question deals with the withdrawal of public domain from entry ordered by President Taft on September 27, 1909. It will be remembered that President Taft himself doubted the legality of the order and after some months an act of Congress was passed definitely vesting in the President the necessary authority to make such withdrawals as he might deem advisable for the public welfare. The Taft withdrawal order affected 2,871,000 acres of California oil land valued at approximately $1,000,000,000. In rendering his decision Judge Dooling stated in effect that no general power of withdrawal exists, and while withdrawal orders have been frequently upheld, the court could find no case broad enough to cover the withdrawal of over 3,000,000 acres of land from the operation of the mineral land laws, whether in aid of proposed legislation as was stated in the order, or for the purpose of securing a supply of fuel oil for the Navy as stated in the bill. The court held further that the power to dispose of the public lands has been given to Congress by the Constitution and that no conflicting power has been granted to the President of that instrument derogatory to the power given to Congress in this regard. The case in point was that of the United States *versus* the Midway Northern Oil Company and others. The land in question is situated in the San Joaquin valley from the Kern to the Coalinga fields and beyond, including the McKittrick, Midway, and other oil-producing territory.

Generated on 2024-09-30 00:30 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Big Creek Hydro-Electric Power Development*

By WALTER E. JESSUP

AT Big Creek, California, the initial development of one of the most interesting power schemes in the country is being completed. The interest lies in the very high head used, the large amount of power to be obtained from a comparatively small flow of water, the extreme length of the transmission line and the unprecedented height of the transmission line voltage.

Big creek is an 8-mile tributary of the San Joaquin river which rises in the snow-capped Sierras at an elevation of about 8000 ft. and is in Fresno county 70 miles east of Fresno. The upper reaches of Big creek flow through a mountain meadow, which by the construction of dams across each of the three natural outlets forms a basin or lake of nearly 125,000 acre-feet capacity. The lake thus formed is about 4½ miles long and ½ mile wide.

On the north and east of this basin the snow-clad peaks rise to elevations varying from 9000 to 11,000 ft., enclosing a drainage area of 88 square miles. The warm moisture laden winds from the Pacific ocean striking this high barrier are here relieved of a large part of their burdens, and this accounts for the high annual precipitation on this drainage area, usually amounting to over 80 in. The run-off from this drainage area, a large part of which is heavily forested, is about 50 in. annually. The basin contains sufficient storage to develop 80,000 hp. at 50% load factor for 180 days with no water flowing into it. The run-off records covering a period of several years show that with this storage sufficient continuous flow to develop 90,000 hp. at 50% load factor can at all times be expected. The initial development of 80,000 hp. requires approximately 240 sec-ft. for peak load.

The site of this development is in a rough, rugged, and wooded country 56 miles from the nearest railroad connection, and the transportation of the 50,000 odd tons of cement, the machinery, materials, and supplies presented the first big problem. The difference in elevation between the main line of the Southern Pacific railroad at El Prado and the site of power-house No. 1 is some 4400 ft. It was decided early that the usual methods of freighting in this district by 12 and 16-horse freight wagons was out of the question because of the difficulties, the length of time required to make a trip, and the excessive cost. Winter conditions in the mountainous districts made the rate as high as $20 per ton. It was estimated that with a 12-horse freight team arriving every ten minutes day and night on the site, it would require four years to get the necessary freight in. Accordingly a standard-gauge railroad was built from El Prado to the site of power-house No. 1 at Cascada. The railroad has been incorporated under the name of the San Joaquin &

*Abstract from the *Wisconsin Engineer*, February 1914.

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Eastern Railroad as a common carrier under the laws of the state of California. For half of the distance the route leads through an easy rolling country where 20° curves and 2½% grades are the maximum; but after leaving this flat lower country at Auberry, the railroad starts a rapid ascent as it enters the Sierra National Forest Reserve and follows the grade contour of the country very closely with 60° curves and 5% uncompensated grades for the maximums. Sixty-ton Shay locomotives of standard-gauge hoist which operates up the 2000-ft. hill to the basin above. The top of the hoist, nearly 5000 ft. long, is connected with a railroad of some 7 miles of track, connecting the dams, the gravel pit, the sawmill, and the various camps in the basin. Eight construction locomotives and a full equipment of dump, flat, and gravel cars handled the material for the construction of the three dams situated here.

The floor of the basin is at an ele-

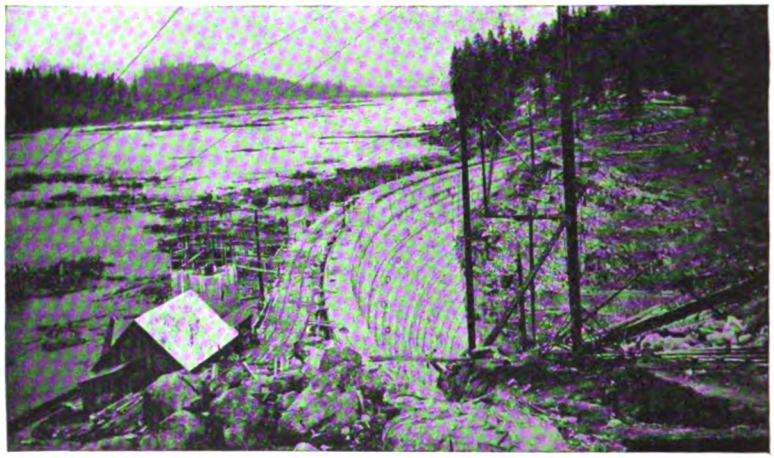


FIG. 1. DAM 3, BASIN LAKE, AND THE INTAKE TOWER LEADING INTO TUNNEL NO. 1.

the geared type are required for the mountain division and have given very satisfactory service. This division might well be called the 'Route of a Thousand Curves,' and the natural scenery is of a tourist-attracting beauty and grandeur. The time required for the building of the road, including the location surveys, the purchase of right-of-way, the arrangements for Government permits and actual construction was but 165 days, and probably sets a record for rapid railroad building in difficult country.

At Cascada a complete railroad yard was laid out and connected with a

vation of 6800 ft. and the plans for the initial development call for a water elevation in the lake of 6915 ft. Dam No. 1, the largest on the project, is built across the outlet through which Big creek leaves the meadow and is 140 ft. high at its highest point, and 812 ft. long. The central portion of the dam is arched upstream with a radius of 954 ft. and connects the end sections or retaining dikes. The section is of the triangular gravity type, with the upstream face vertical and the downstream face stepped and roughened to bond the concrete which will be added to the section when the

Generated on 2024-09-30 00:35 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

dam is ultimately raised 50 ft. higher. The added 50 ft. of storage will supply the ultimate development at such time as the market for power demands it. This dam is constructed of mass concrete and large pudding stone, and contains 59,000 cu. yd. of concrete masonry. Three 42-in. diameter sluice-gates, operated by hand from the top of the dam, are placed so that the lake may be drained, and were used to control the flow of Big creek during the construction period. Dams No. 2 and 3, across the two remaining natural outlets from the meadow, are of similar design. Dam No. 2 is 81 ft. high, 1015 ft. long, arched upstream to a radius of 800 ft., and contains 27,000 cu. yd. of concrete masonry; while dam No. 3 is 126 ft. high, 450 ft. long, arched to a radius of 625 ft., and contains 31,000 cu. yd. of concrete masonry.

FIG. 2. HOIST NO. 1, LEADING FROM CASCADE TO THE BASIN. MAXIMUM GRADIENT 85 PER CENT.

The excavations for the dams were carried to solid rock formation found from 20 to 90 ft. below the surface. Gravel was hauled in from a pit in the

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

basin now covered by the lake, by locomotives connecting the dams. Much of the large rock and stone used was taken from the sites of the dams and placed by stiff-legged derricks. Lumber for forms was cut in a sawmill built for the purpose, the pine trees cut in clearing the site of the lake being used. The motor-driven concrete mixers were placed above the forms at an elevation high enough to deposit the whole mass by gravity. Wooden chutes led from the mixers to the space between the forms. The concrete plant was capable of depositing from 1000 to 1500 cu. yd. of concrete per day, the work being carried on continuously. Provision was made in the tops of the dams for flash-boards and they have been installed, raising the elevation of the lake to 6920, 5 ft. higher than the top of the spillways.

Below the meadow the course of Big creek is very precipitous, dropping 4000 ft. in 6 miles, all of which is available for power. This drop is divided by nature into two nearly equal parts, the first 2100 and the second 1860 ft., and a power-house is now at the base of each of these power drops, power-house No. 1 being at Cascade, the end of the construction railroad, and the other 5 miles farther down the stream.

Water from the basin lake is taken into the tunnel and flow-line pipe leading to the head of the penstocks of power-house No. 1 through an intake tower near the west end of dam No. 1. This tower is built of reinforced concrete with a 20-ft. internal diameter and a height of 104 ft. To prevent débris from passing in with the water, the entrance, extending from the top to the bottom of the tower, contains steel bar screens. The entrance screens are divided into three vertical sections, 7 ft. 6 in. wide, and are to be kept free from clogging débris by motor driven rakes designed to operate over the whole area of the screens.

A 9-ft. diameter gate at the bottom of the tower and opposite the screen controls the flow into tunnel No. 1. The gate and its bearings are necessarily of heavy construction, the design calling for a gate to stand the pressure head produced when the lake level is raised to its ultimate elevation of 6965 ft., 50 ft. higher than the level of the present spillways. This would produce a head of 140 ft. on the gate and a total pressure of some 275 tons. The disk is operated by two stems and the operating machinery is designed to open the gate under this maximum unbalanced pressure. However, the pressure on the two sides of the disk may be equalized by opening a 24-in. diameter by-pass valve just above the main gate and discharging into a 36-in. diameter air shaft which leads from the top of the tower to the tunnel. A foot bridge from the top of the dam leads to the house on the top of the tower enclosing the rakes and gate operating machinery. The 36-in. air shaft provides for an entrance for air when draining the tunnel and a ladder in it gives access to the tunnel for inspection purposes.

The tunnel is 12-ft. diameter, 3880 ft. long, and is driven on a grade of 2 ft. per 1000 through a solid granite ridge along the shore of the lake. The tunnel has a capacity large enough to drive six 20,000-hp. Pelton wheel units under the 1900-ft. effective head available at power-house No. 1. The tunnel has been made this excessive size to provide for future installations in the power house. After passing through the ridge the tunnel connects with a 108-in. diameter pipe, ½ in. thick, with double riveted longitudinal joints and

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

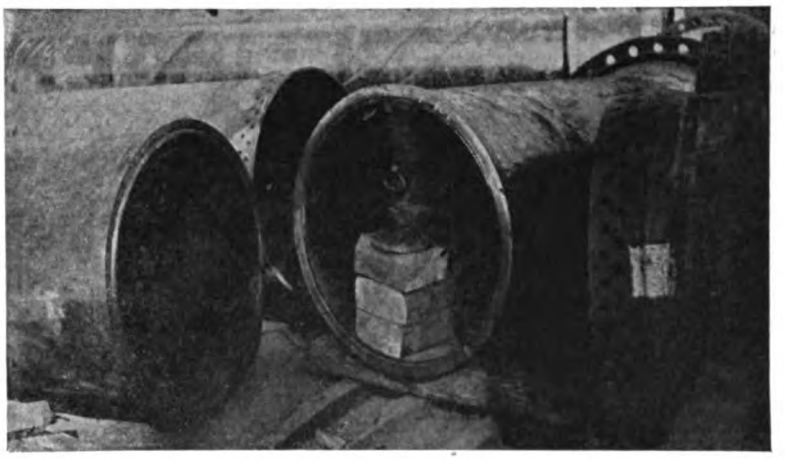


FIG. 3. LAP WELDED PENSTOCK PIPE, WITH BOTH BOLTED FLANGE AND BELL-AND-SPIGOT RIVETED JOINTS.

single riveted circular seams, the connection being made 400 ft. inside the portal. The pipe is securely anchored to the bore of the tunnel and concreted into place with a pressure-tight joint. That part of the tunnel containing the pipe is lined with concrete and is large enough in diameter to allow inspection of the outside of the pipe. At the tunnel portal the 108-in. pipe branches into two 84-in. outlets one of which is closed, not being needed for the initial development.

From the other outlet an 84-in. pipe, capable of supplying four 2000-hp. Pelton wheel units, leads around the grade contour of the mountain, 6840 ft. to the head of the penstocks. This pipe is laid on a grade of 8.4 ft. per 1000, and as completed, lies everywhere so that it has at least 1 ft. of earth covering for protection against rolling rocks and freezing. Manholes for inspection purposes are provided at intervals of 2000 ft. The thickness of plate varies from $\frac{3}{8}$-in. at the upper end to $\frac{1}{2}$ in. at the

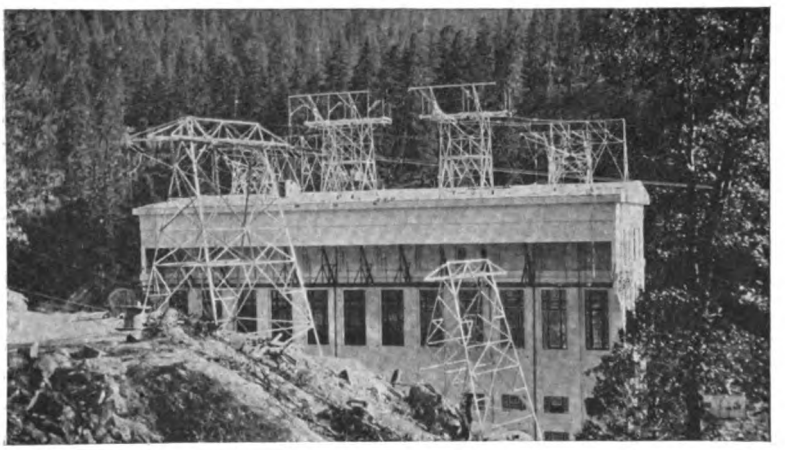


FIG. 4. POWER-HOUSE NO. 1 COMPLETED.

Generated on 2024-09-30 00:30 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

lower end as the pressure head increases. The longitudinal seams of the ⅜-in. plates are double and triple riveted as the stresses increase and the ½-in. plates are all double riveted. This pipe was furnished by the Willamette Iron & Steel Company.

The 84-in. pipe terminating at a point 1942 ft. above power-house No. 1 and 4500 ft. therefrom, divides here into four 44-in. diameter outlets, two of which are closed for the initial development. The remaining two outlets are connected through 42-in. hand and motor operated valves direct to the head of the pressure penstocks. These valves have electrical connection with the power-house switchboard below for remote control of the water leaving the flow-line and entering the penstocks. Just below these valves 24-in. standpipes extend up the hillside a distance of 425 ft. and terminate in 36-in. vertical surge tanks extending to an elevation equal to that of the water in the lake.

Just below the gate house for the two 42-in. valves the two penstock pipes begin their descent in two parallel lines, 7 ft. apart, with varying vertical and horizontal angles to correspond to the topography of the steep and rocky slope to the power-house. The maximum slope angle is about 43°, corresponding to a gradient of 93%, and the minimum slope angle about 5°, corresponding to a gradient of 9%. The pipes are of lap-welded steel tubes, manufactured and furnished by the Mannesman Rohren werke of Dusseldorf, Germany.

Each tube is about 26 ft. long and varies from 42-in. diameter and ⅜ in. thick at the top to 24-inch diameter and 1 inch thick at the bottom. The sections vary in weight from 3 to 7 tons, according to the thickness and diameter. Up to a head of 1460 ft. the joints are of a bell and spigot type, the circular joint being made with a double row of rivets. For heads greater than this, bolted flange joints of special design, with a rubber gasket of $\frac{5}{16}$-in. sectional diameter were used. For a given diameter of pipe the thickness increases with the head until the maximum allowable thickness of $1\frac{3}{16}$ in. is reached when the diameter is reduced 2 in. and this diameter used up to the maximum thickness again. This method was used down to the 36 by 26 by 26 in. breeches joint, 800 ft. back of the power-house, where each pipe divided into two 26-in. pipes, one pipe leading to each of the two nozzles of a unit. Each pipe length was tested to one and one-half times the static head required before shipment.

Just outside the power-house each of the four 26-in. lines connect into 24-in. hydraulically operated valves, this diameter continuing to the nozzles. These valves are designed for a pressure of 1000 lb. per square inch, but were tested out at 1500 lb. per square inch without developing any weakness. They weigh 20,000 lb. each and were manufactured by the Allis-Chalmers Company of Milwaukee. In order to facilitate the operation of these 24-in. valves with an unbalanced pressure of nearly 200 tons when the valve is closed, a 4-in. by-pass is provided discharging into the pipe leading to the needle nozzle beyond the valve, thus equalizing the pressure on both sides of the main valve disk.

The power-house is a reinforced concrete and structural steel building 84 ft. wide, 171 ft. long, and 103 ft. high. In it are built five floors and a basement, a stairway in the central portion of the building making all parts readily accessible. The room containing the main generating machinery extends the

Generated on 2024-09-30 00:36 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

whole length and half the width of the building, extending upward to the fourth floor. A 100-ton Cleveland electric traveling crane is installed in this room for placing the machinery and handling the apparatus. It was intended to use reinforced concrete as far as economical in the building, but the great weight of the transformers, oil switches, buss structures, and switchboard above the main floor required

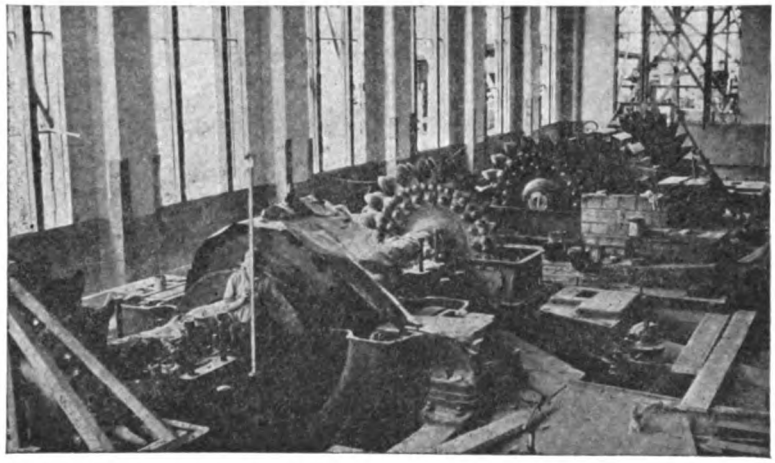


FIG. 5. INTERIOR OF MAIN OPERATING ROOM, SHOWING TWO UNITS PARTLY INSTALLED.

structural shapes for an economical design of the floors, and the concrete roof slab is supported on steel roof trusses. The present building is large enough to house three 20,000-hp. units, two of which are now in place, and has one end temporarily closed with expanded metal lath and concrete plaster to allow of future extensions.

Each generating unit consists of a 50-cycle 6600-volt generator mounted between and on the same shaft with two Pelton overhung water-wheels, one wheel being mounted on each end of the shaft. The shafts are hollow-forged nickel steel, 27 in. diameter at the rotor fit, 20 in. diameter at the bearings, and 29 ft. long. The impulse wheels are 94 in. diameter at the impulse circle and have 19 cast steel buckets fastened to the nickel steel wheel disk by three pressure-fitted bolts. These are the largest impulse wheels ever manufactured in this country and operate under one of the highest heads in the world. The generator rotor and the two wheels were pressed on to the shaft with a large hydraulic jack which screwed into the end of the shaft. The rotor, shaft, and motor-wheels weigh over 100 tons.

The normal speed of the shaft is 375 r.p.m., and the unit generates 20,000 hp. at this speed under the 1900 ft. effective head. The rotating parts, however, are designed to stand a runaway speed of 750 r.p.m. For purposes of comparison, it may be mentioned that the enormous turbines of the Keokuk plant are capable of generating but 10,000 hp. each, and are of the same capacity as one single 94-in. Pelton wheel of the Big Creek project. Each generator has a continuous rating of 17,500 kva. at any power factor from 80% lagging to an 80% leading current, with an overload capacity of

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

21,000 kva. for one minute and 25,000 kva. momentarily. No larger generators of this type have been built.

The main shaft of a unit is supported on two self-aligning babbitted bearings, 20 in. diameter and 60 in. long, one on each side of the generator and between it and the runners. The bearings are of the ring-oiled water-cooled type. The clearance between the stator and the rotor of the generator is so designed that while operating the electrical pull just about balances the dead weight of the revolving parts and the thrust due to the action of the jets on the wheels. When operating under full load, the water issues from the nozzles in jets 5½ in. diameter and at a velocity of about 350 ft. per second. It is difficult to realize the energy in a jet of this kind until one has had the opportunity of seeing it in operation.

The nozzle is permanently fixed with respect to the bucket circle, and the needle, through the governing apparatus, regulates the size of the jet to suit the load on the unit. The governors, one on each unit, are of the automatic hydraulic oil relay and hand-operated type of the latest design, the fly-ball unit being enclosed and connected by belting to the main shaft. An electrical connection between the main switchboard and the governors may also be used to adjust the jet diameter by operating the needle through the governor mechanism. The governors are arranged so that either wheel of a unit may be operated without the other, although while generating more than 10,000 hp. both wheels will be operating and will be regulated simultaneously and equally by the governing device.

Should the load on a unit be suddenly thrown off or 'lost,' the governor would suddenly close the jets and create an undue water hammer pressure in the penstock line. To protect the penstocks against this extreme pressure, a pressure regulator is connected to the inlet pipe back of the nozzle and can either be operated by the governor direct or used as a synchronous by-pass. When acting as a by-pass, the valve opens when the pressure rises beyond the danger point and automatically closes as it returns to normal. This type of regulating valve is of the same capacity as a nozzle, and the velocity of the water issuing from it is absorbed by an energy absorber, after which the water discharges into the steel-lined tail-race below the main jets.

The two direct-current exciters located behind the main units are arranged for either water-wheel or induction-motor drive. They are of 350-hp. capacity and operate at 750 r.p.m. and 250 volts. Each exciter is of sufficient capacity to excite both main units. These small water-wheels are 47 in. diameter and have 24 buckets bolted in place on the wheel rim. The nozzle is fixed and the jet is $1\frac{5}{16}$ in. diameter. The speed is controlled either by operating the needle nozzle by hand or by an automatic governor control. For a sudden release of load, the water jet is deflected from the buckets by a steel hood operated by the governing apparatus. The water to supply these wheels is taken from an 8-in. header connecting the four penstock pipes just above the main 24-in. valves and is brought to the nozzles in 6-in. pipes.

The exciting generator is of the interpole compound wound type with the shunt winding arranged so that the halves may either be connected in series for self excitation at 250 volts or in parallel for separate excitation by other regulating exciter sets called agitators. An agitator set consists of a small 250-volt motor-driven generator connected differentially to a similar 125-volt generator to give 125 volts for normal ex-

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

citation, but with a regulating range down to 0 volts. There are two sets of agitators, each of sufficient capacity to excite two main exciters.

In the basement beneath the main operating floor the oil tanks and pumps are placed for the power-house oiling system. The 2½-in rotary oil pumps are either motor or water-wheel driven, and take the oil from the main storage tanks and force it into the pressure tanks under a pressure of 200 lb. per square inch. This oil under pressure operates the valves and cylinders of the governors and then flows back through the filters to the storage tanks. The pressure system is also connected to the lower side of the main bearings through a reducing valve so that oil under pressure may be forced into the bearing before the shaft has gained enough speed for the ring oiling system to properly lubricate the bearing. This oil system also supplies the trans-

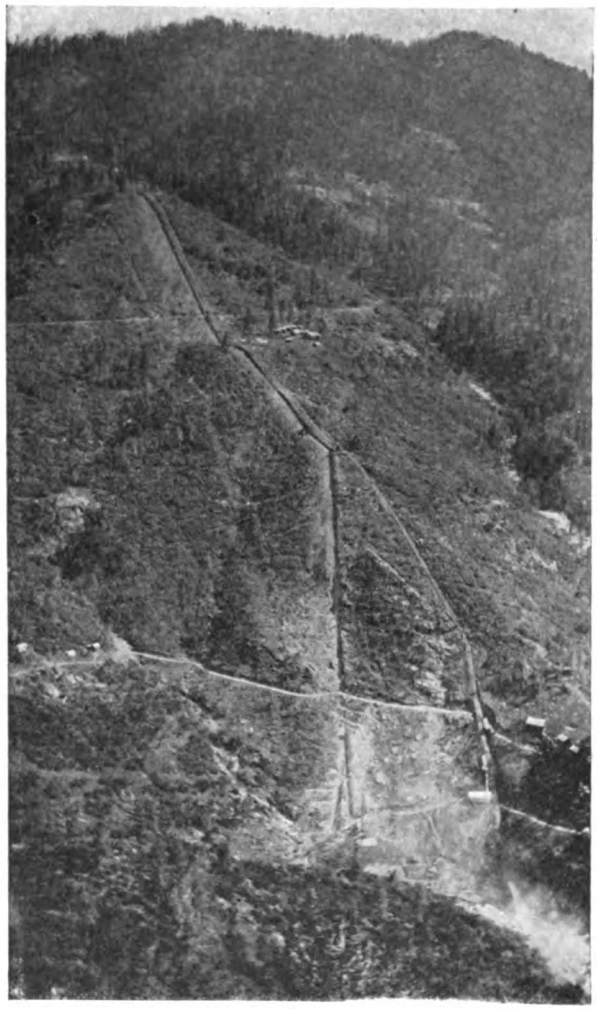


FIG. 6. POWER DROP NO. 2, SHOWING HOIST LINE ON THE RIGHT AND PENSTOCK LINE ON THE LEFT.

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

formers and the high-tension switches.

The high-tension electrical equipment is of interest. The current is generated at 6600 volts and stepped up to 150,000 volts for transmission. These step-up transformers are made up of three single-phase oil-insulated and water-cooled elements, carrying 6600 volts delta-connected on the low side and 86,700 volts Y-connected on the high-tension side. Each of these elements is 15 ft. diameter and 26 ft. high and weigh when charged with the required 9500 gal. of oil nearly 80 tons. The 150,000-volt switches consist of three single-pole elements mounted in separate tanks of oil and are of the remote control, non-automatic, electrically operated type. Each switch complete occupies a space 6 by 20 ft., 10 ft. in height, and weighs 14 tons.

Just above power-house No. 1, Pitman creek, a tributary to Big creek, enters. It drains a small area adjacent to the basin lake and the run-off therefrom can be used to good advantage at power-house No. 2, since the operating head is some 200 ft. less than at power-house No. 1 and will require, therefore, more water for the same size generating units. This water is collected and together with the water discharged from the power-house, is diverted into tunnel No. 2 by dam No. 4, which has been built in the Big Creek gorge some 300 ft. below the power-house.

The foundation of dam No. 4 is on the exposed solid granite formation of the narrow gorge, and the dam is constructed of mass concrete 73 ft. high, 288 ft. long, and arched to a radius of 150 ft. It is not of the gravity section and depends on arch action for stability. The upper face slopes slightly upstream from the vertical and the section is triangular in shape. A 72-in. sluice gate is operated from the top of the dam and was used during construction to control the flow of Big creek. Piers for supporting 9-ft. flashboards are built on the top of the spillway, and with the sluice-gate control the flow of water going to power-house No. 2 through the tunnel. The elevation of the water in this small reservoir at the spillway elevation of 4814 ft. may be raised to within 5 ft. of the nozzles in the power-house.

At the south end of the dam and on the side of the creek opposite the power-house, entrance tunnel No. 2 is situated. Steel-bar screens are built into the concrete construction of the headworks and a large gate similar to the one at the entrance to tunnel No. 1 is provided. The tunnel is built 9 ft. diameter, is 21,300 ft. long, and on a grade of 3.2 ft. per thousand. It was driven from the two portals and each way from eight adits situated about equidistant along the line of the tunnel. The tunnel is not straight, but angles slightly at various points so that the adits would be as short as possible and still provide for at least 200 ft. of cover at all points. It is unlined except at a few points where the rock formation was poor and there concrete lining was put in. The tunnel ends in a concrete-lined surge chamber, 30 ft. diameter and 120 ft. high, extending from the top of the tunnel to the surface of the ground. A 9-ft. gate connects the surge chamber with a 108-in. pipe extending through a concrete-lined tunnel for 250 ft. to the head of the penstocks. The gate is provided with two operating stems and an equalizing by-pass discharging into a 30-in. air shaft similar to the arrangement at the entrance to tunnel No. 1. The water entering the penstocks is controlled by two valves operated either by hand or electrically from the power-house switchboard, and a standpipe on

Generated on 2024-09-30 00:36 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

each line extends vertically upward to an elevation equal to the top of the flashboards on dam No. 4.

The penstocks to power-house No. 2 are exactly similar in design and construction to those leading to the other power-house. The construction and equipment of power-house No. 2 is identical with that of power-house No. 1, except that the electrical equipment instead of being of General Electric is of Westinghouse design, and in order to get the same power with smaller effective head the amount of water and therefore the number of runner buckets must be increased. Instead of 19 buckets there are 21 buckets on the runners of the power-house No. 2 units.

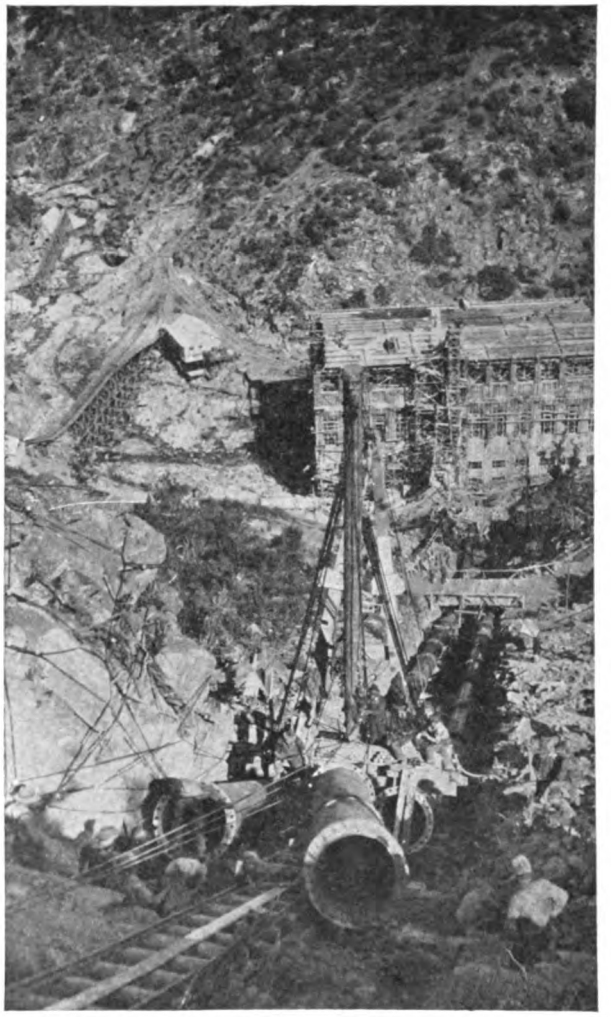


FIG. 7. LAYING PENSTOCK IN LINE NO. 2; 93 PER CENT GRADIENT ABOVE POWER-HOUSE NO. 2.

The San Joaquin & Eastern railroad follows close to the line of tunnel No. 2, and a standard-gauge hoist 4300 ft. long connects with the railroad at the west portal of tunnel No. 2 to carry materials and the machinery to the

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

formers and the high-tension switches.

The high-tension electrical equipment is of interest. The current is generated at 6600 volts and stepped up to 150,000 volts for transmission. These step-up transformers are made up of three single-phase oil-insulated and water-cooled elements, carrying 6600 volts delta-connected on the low side and 86,700 volts Y-connected on the high-tension side. Each of these elements is 15 ft. diameter and 26 ft. high and weigh when charged with the required 9500 gal. of oil nearly 80 tons. The 150,000-volt switches consist of three single-pole elements mounted in separate tanks of oil and are of the remote control, non-automatic, electrically operated type. Each switch complete occupies a space 6 by 20 ft., 10 ft. in height, and weighs 14 tons.

Just above power-house No. 1, Pitman creek, a tributary to Big creek, enters. It drains a small area adjacent to the basin lake and the run-off therefrom can be used to good advantage at power-house No. 2, since the operating head is some 200 ft. less than at power-house No. 1 and will require, therefore, more water for the same size generating units. This water is collected and together with the water discharged from the power-house, is diverted into tunnel No. 2 by dam No. 4, which has been built in the Big Creek gorge some 300 ft. below the power-house.

The foundation of dam No. 4 is on the exposed solid granite formation of the narrow gorge, and the dam is constructed of mass concrete 73 ft. high, 288 ft. long, and arched to a radius of 150 ft. It is not of the gravity section and depends on arch action for stability. The upper face slopes slightly upstream from the vertical and the section is triangular in shape. A 72-in. sluice gate is operated from the top of the dam and was used during construction to control the flow of Big creek. Piers for supporting 9-ft. flashboards are built on the top of the spillway, and with the sluice-gate control the flow of water going to power-house No. 2 through the tunnel. The elevation of the water in this small reservoir at the spillway elevation of 4814 ft. may be raised to within 5 ft. of the nozzles in the power-house.

At the south end of the dam and on the side of the creek opposite the power-house, entrance tunnel No. 2 is situated. Steel-bar screens are built into the concrete construction of the headworks and a large gate similar to the one at the entrance to tunnel No. 1 is provided. The tunnel is built 9 ft. diameter, is 21,300 ft. long, and on a grade of 3.2 ft. per thousand. It was driven from the two portals and each way from eight adits situated about equidistant along the line of the tunnel. The tunnel is not straight, but angles slightly at various points so that the adits would be as short as possible and still provide for at least 200 ft. of cover at all points. It is unlined except at a few points where the rock formation was poor and there concrete lining was put in. The tunnel ends in a concrete-lined surge chamber, 30 ft. diameter and 120 ft. high, extending from the top of the tunnel to the surface of the ground. A 9-ft. gate connects the surge chamber with a 108-in. pipe extending through a concrete-lined tunnel for 250 ft. to the head of the penstocks. The gate is provided with two operating stems and an equalizing by-pass discharging into a 30-in. air shaft similar to the arrangement at the entrance to tunnel No. 1. The water entering the penstocks is controlled by two valves operated either by hand or electrically from the power-house switchboard, and a standpipe on

Generated on 2024-09-30 00:43 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

each line extends vertically upward to an elevation equal to the top of the flashboards on dam No. 4.

The penstocks to power-house No. 2 are exactly similar in design and construction to those leading to the other power-house. The construction and equipment of power-house No. 2 is identical with that of power-house No. 1, except that the electrical equipment instead of being of General Electric is of Westinghouse design, and in order to get the same power with smaller effective head the amount of water and therefore the number of runner buckets must be increased. Instead of 19 buckets there are 21 buckets on the runners of the power-house No. 2 units.

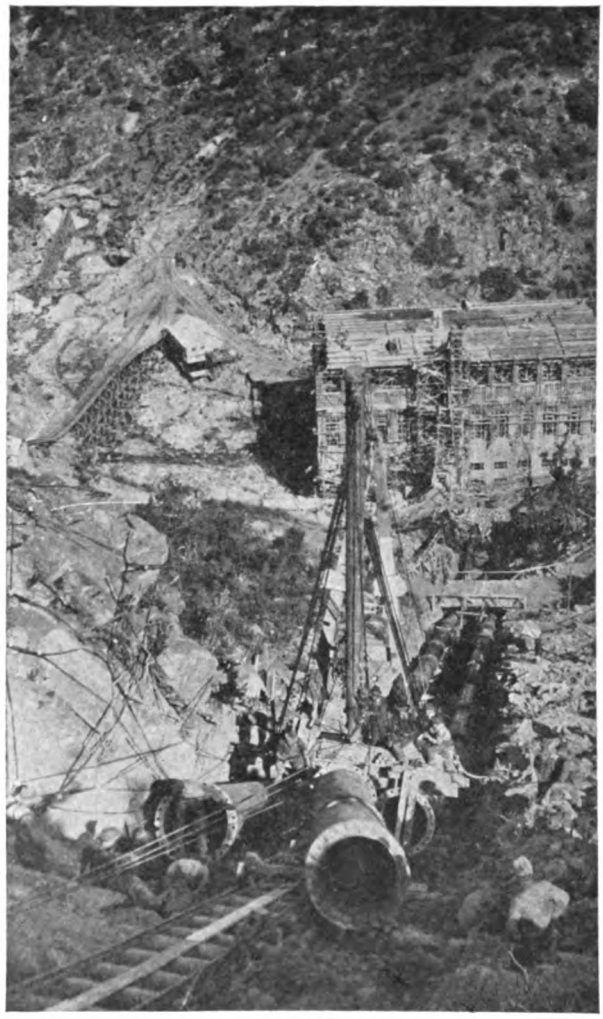


FIG. 7. LAYING PENSTOCK IN LINE NO. 2; 93 PER CENT GRADIENT ABOVE POWER-HOUSE NO. 2.

The San Joaquin & Eastern railroad follows close to the line of tunnel No. 2, and a standard-gauge hoist 4300 ft. long connects with the railroad at the west portal of tunnel No. 2 to carry materials and the machinery to the

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

site of power-house No. 2. The maximum gradient on this incline is about 85 per cent.

The transmission lines lead from the power-houses and after extending 240 miles in a southerly direction across two mountain ranges and a part of the Mojave desert, reach the main distributing station at Eagle Rock, 9 miles from Los Angeles. There are two tower lines spaced 80 ft. apart on centres in a cleared right-of-way 150 ft. wide. The towers are built of galvanized structural shapes and are designed to stand the breaking of two conductors on the same side of the tower. Anchor and angle towers are designed to stand the breaking of all three of the conductors and the ground cable and a pull at right angles to the line large enough to allow the use of the tower to turn angles of 60 degrees.

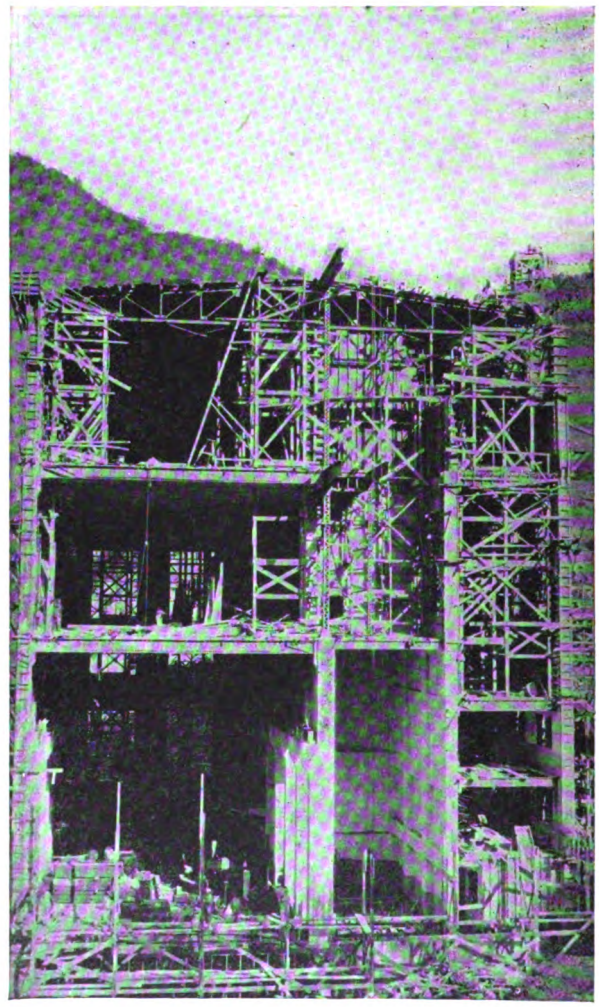


FIG. 8. END VIEW OF TEMPORARY END OF POWER-HOUSE NO. 2, SHOWING INTERIOR ARRANGEMENT.

The conductors are of aluminum and steel cable 1 in. diameter, containing a

Generated on 2024-09-30 00:36 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

central core of 7 strands of plow steel with 54 strands of aluminum wire surrounding it. The conductors weigh 4058 lb. per mile of single line. They are placed in a horizontal plane with a 7-strand galvanized steel ground cable above, and are sagged for a minimum ground clearance of 25 ft., with a maximum stress of 7500 lb. Under normal conditions the span is 660 ft., but in sleet country this is reduced to 550 ft. There are in all 3400 towers and over 5,000,000 lb. of conductor and ground cable. At Eagle Rock substation current is stepped down to 72,000 volts and 18,000 volts for transmission to Los Angeles and vicinity. The substation is of reinforced concrete and structural steel 168 ft. long, 106 ft. high, and 131 ft. wide, similar in architectural treatment to the two power-houses. The main transmission lines come in onto the roof and are taken into the building through a set of aluminum cup electrolytic lightning arresters, to the main step-down transformers. Two 15,000-kva. synchronous condensers operating at 6600 volts and 375 r.p.m. are installed here to regulate the power factor on the line and keep it as low as possible. These condensers are exactly similar in size and construction to the main generators at the power-houses and are each connected up to the line through their transformers and operate under no load whatever, their only province being to induce enough leading current by proper regulation of its field excitation to offset the lagging current induced by the street car and city induction motor loads. They are arranged either for self-excitation from an exciter on the shaft of each machine or from a separate exciter set.

The entire development belongs to the Pacific Light & Power Co. of Los Angeles and the reported cost of $12,000,000 has been borne by them. The current is already being used to operate the street and interurban cars of Los Angeles and to relieve the overloaded conditions of the local lines. The entire project has been designed and constructed by the Stone & Webster Construction Co. of Boston in a little over two years.

Generated on 2024-09-30 00:39 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

site of power-house No. 2. The maximum gradient on this incline is about 85 per cent.

The transmission lines lead from the power-houses and after extending 240 miles in a southerly direction across two mountain ranges and a part of the Mojave desert, reach the main distributing station at Eagle Rock, 9 miles from Los Angeles. There are two tower lines spaced 80 ft. apart on centres in a cleared right-of-way 150 ft. wide. The towers are built of galvanized structural shapes and are designed to stand the breaking of two conductors on the same side of the tower. Anchor and angle towers are designed to stand the breaking of all three of the conductors and the ground cable and a pull at right angles to the line large enough to allow the use of the tower to turn angles of 60 degrees.

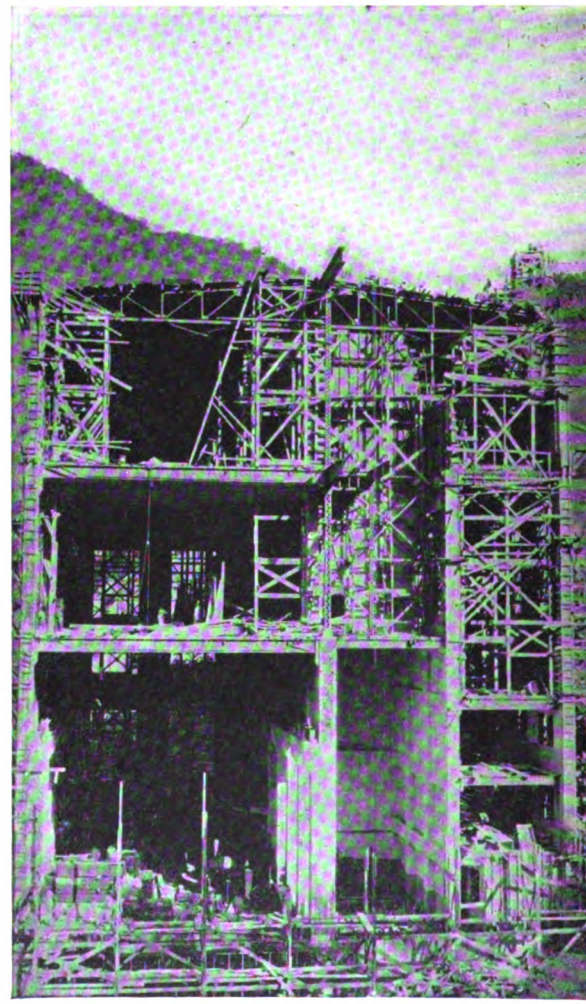


FIG. 8. END VIEW OF TEMPORARY END OF POWER-HOUSE NO. 2, SHOWING INTERIOR ARRANGEMENT.

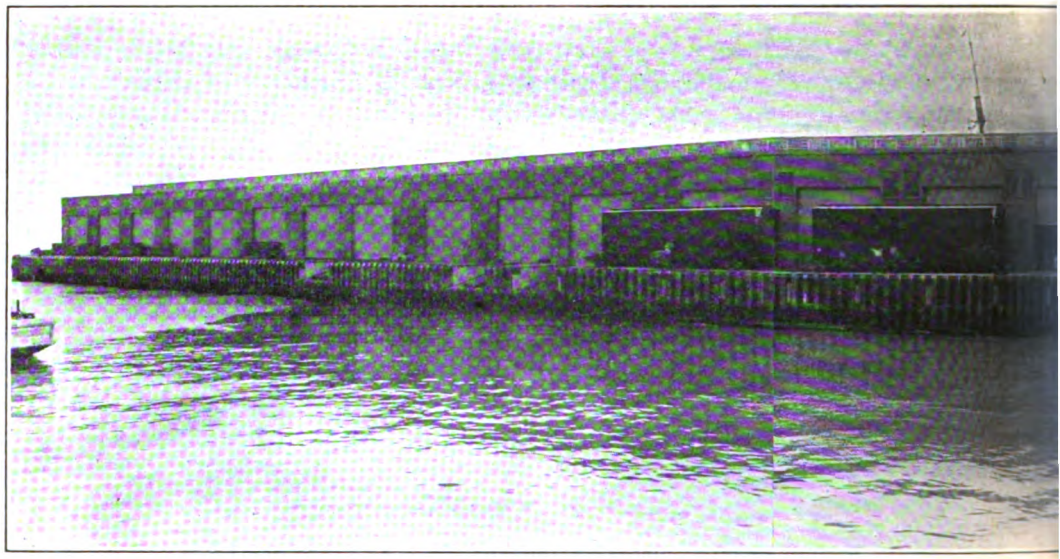
The conductors are of aluminum and steel cable 1 in. diameter, containing a

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

central core of 7 strands of plow steel with 54 strands of aluminum wire surrounding it. The conductors weigh 4058 lb. per mile of single line. They are placed in a horizontal plane with a 7-strand galvanized steel ground cable above, and are sagged for a minimum ground clearance of 25 ft., with a maximum stress of 7500 lb. Under normal conditions the span is 660 ft., but in sleet country this is reduced to 550 ft. There are in all 3400 towers and over 5,000,000 lb. of conductor and ground cable. At Eagle Rock substation current is stepped down to 72,000 volts and 18,000 volts for transmission to Los Angeles and vicinity. The substation is of reinforced concrete and structural steel 168 ft. long, 106 ft. high, and 131 ft. wide, similar in architectural treatment to the two power-houses. The main transmission lines come in onto the roof and are taken into the building through a set of aluminum cup electrolytic lightning arresters, to the main step-down transformers. Two 15,000-kva. synchronous condensers operating at 6600 volts and 375 r.p.m. are installed here to regulate the power factor on the line and keep it as low as possible. These condensers are exactly similar in size and construction to the main generators at the power-houses and are each connected up to the line through their transformers and operate under no load whatever, their only province being to induce enough leading current by proper regulation of its field excitation to offset the lagging current induced by the street car and city induction motor loads. They are arranged either for self-excitation from an exciter on the shaft of each machine or from a separate exciter set.

The entire development belongs to the Pacific Light & Power Co. of Los Angeles and the reported cost of $12,000,000 has been borne by them. The current is already being used to operate the street and interurban cars of Los Angeles and to relieve the overloaded conditions of the local lines. The entire project has been designed and constructed by the Stone & Webster Construction Co. of Boston in a little over two years.

Generated on 2024-09-30 00:38 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



Pier Twenty-Eight,

By FRANK G. WHITE,

WHILE not the largest or the most expensive of the group of piers mentioned in the article of July 1913,† descriptive of the water front of San Francisco, pier 28 is a good example of the reinforced concrete piers which are being constructed by the Board of State Harbor Commissioners. It is 150 ft. in width and 677 ft. in length, these dimensions having been agreed upon as satisfactory to the Matson Navigation Company, to which the pier was assigned.

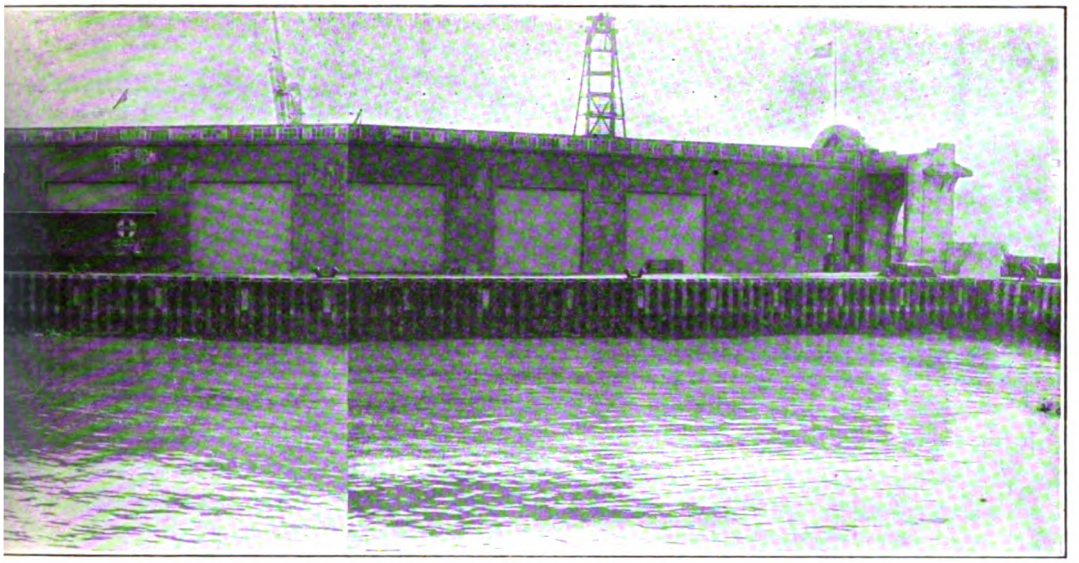
Construction of Cylinders

The pier is supported on 452 reinforced concrete cylinders which are spaced approximately 15 ft. apart in both directions. About one half of the cylinders are 3 ft. 6 in. diameter and the remainder are 4 ft. diameter. The bases of the cylinders are from 5 to 7 ft. diameter and 4 ft. in depth and rest on a compact bed of sand, clay and gravel at a depth of from 50 to 80 ft. below city base. Five tons per sq. ft. has been taken as a safe working load on the foundation. The cylinders and bases were constructed in cylindrical open steel caissons 8 ft. diameter which were sunk to the required depth by dredging out inside with orange peel buckets and driving with a pile driver, as the excavated material was removed. After the caissons were sealed by driving into the hard bottom, the water was baled out by means of stevedore's tubs holding from 300 to 350 gallons of water which were hoisted and dumped by a two-drum hoisting engine.

The steel caissons were built up of steel plates varying in thickness from ⅜-in. at the top to ¾-in. at the bottom. The joints were of the butt type with butt straps 1 in. thick on the outside and the double rows of rivets were

†*Western Engineering*, Vol. 3, No. 1, page 11.

Generated on 2024-09-30 00:37 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



San Francisco

Assoc. M. Am. Soc. C. E.*

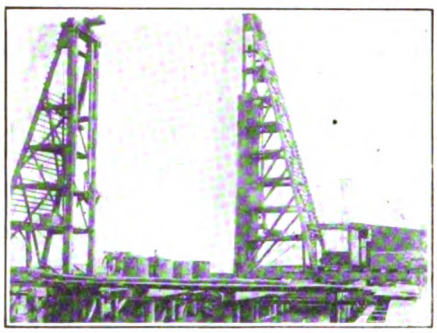
countersunk on the inside. The cutting edge was reinforced with a beveled ring 1 in. thick riveted on the outside. The caissons weighed about 27½ tons each, and were handled by a specially constructed top driver equipped with a 60-hp. hoisting engine. In pulling the caissons, six-sheave blocks taking a ⅞-in. wire cable were used. The driving was done with a 5000-lb. drop hammer fitted in removable leads and operating on a driving head constructed of crossed 12 by 12 in. timbers with bearing plates to receive the upper edge of the caisson and a 24 by 24 in. block of laurel to receive the blow from the hammer.

After the caissons were driven and bailed, and the last of the water pumped out, the hard bottom was excavated by hand to an even bearing and the base and cylinder forms and cylinder reinforcement were set in place inside. The forms were built up of 2-in. stave lumber hooped with ⅝-in. round steel bands. The cylinder reinforcement consists of from ten to fourteen ⅞-in. square bars spirally hooped with No. 0 wire spaced 12 in. between turns. The reinforcing cages were fabricated alongside the cylinder forms and were pulled into the forms by means of a small hand windlass and wire cable. After being securely wired together and braced, the forms with the reinforcing steel inside were rolled overboard, floated to position, hoisted and lowered into the caissons as a unit. After the cylinder forms were set up and braced, the wires were cut, the reinforcing cages dropped to the bottom and centred in the forms.

The concrete in the cylinders was poured through a jointed pipe and was

*Assoc. M. Am. Soc. C. E.; Assistant Engineer, Board of State Harbor Commissioners, San Francisco.

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



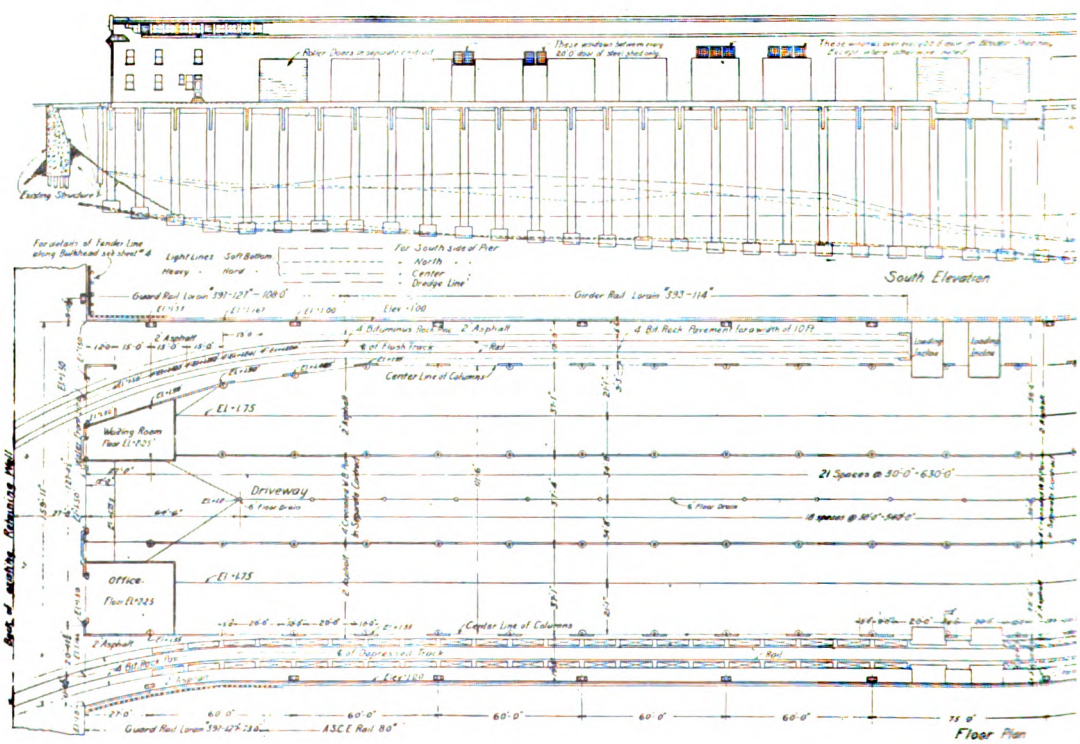
REMOVING CAISSONS.

tamped and spaded so as to fill the 3-in. space between the reinforcing steel and the forms. After the concrete had set not less than twenty-four hours, the caissons were pulled and the cylinders securely braced.

Deck Construction

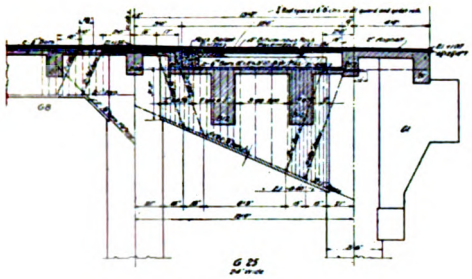
The elevation of the deck of the pier is 1 ft. above city base or about 7.6 ft. above mean high tide. The pier is arranged with a driveway in the centre and a railroad track on each side of the shed outside. The track on the south side is depressed so that the floors of the cars are about level with the deck adjacent, while the rails of the north track are flush with the deck. As the tenants utilize the side ports of their vessels to a considerable extent for loading and discharging, pier 28 was constructed with three cargo inclines 13 ft. 8 in. wide on each side of the pier. The inclines start 23 ft. 4 in. from the edge of the pier and the outer ends are 6 ft. below the level of the deck. As the elevations of the ports change due to tidal conditions or to increased or decreased freeboard, movable gang-planks placed in the inclines give the desired slope for trucking.

The deck is of the ordinary girder,



GENERAL PLAN AN

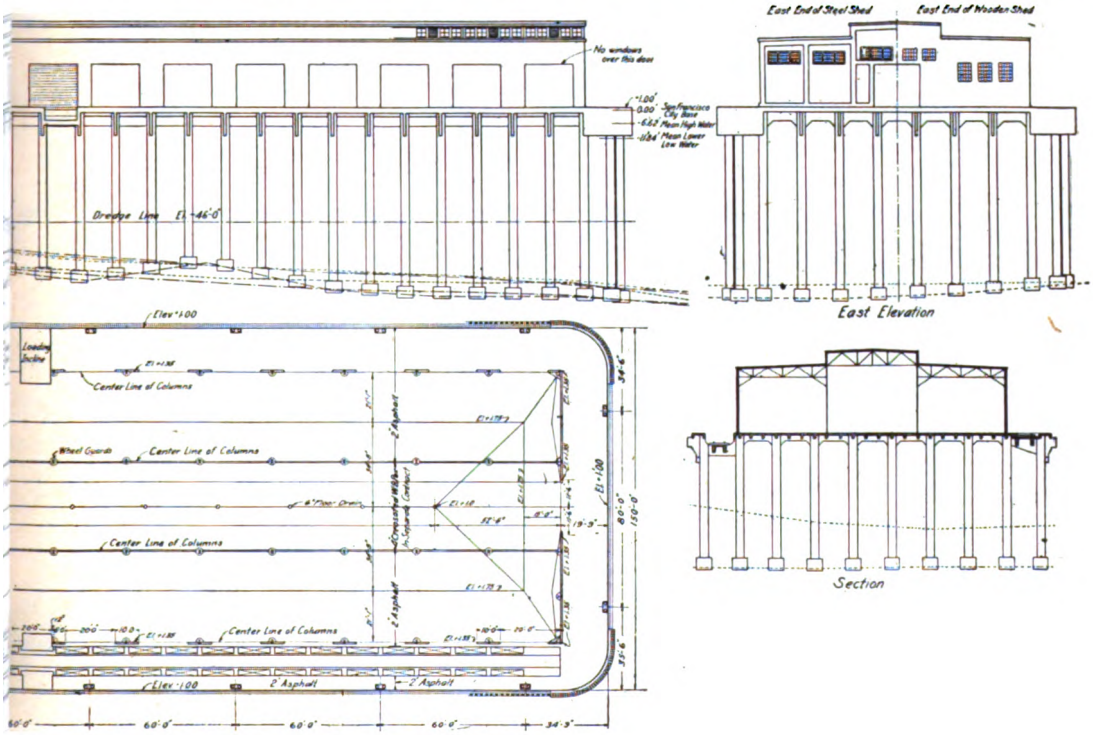
Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



SECTION THROUGH DRIVEWAY.

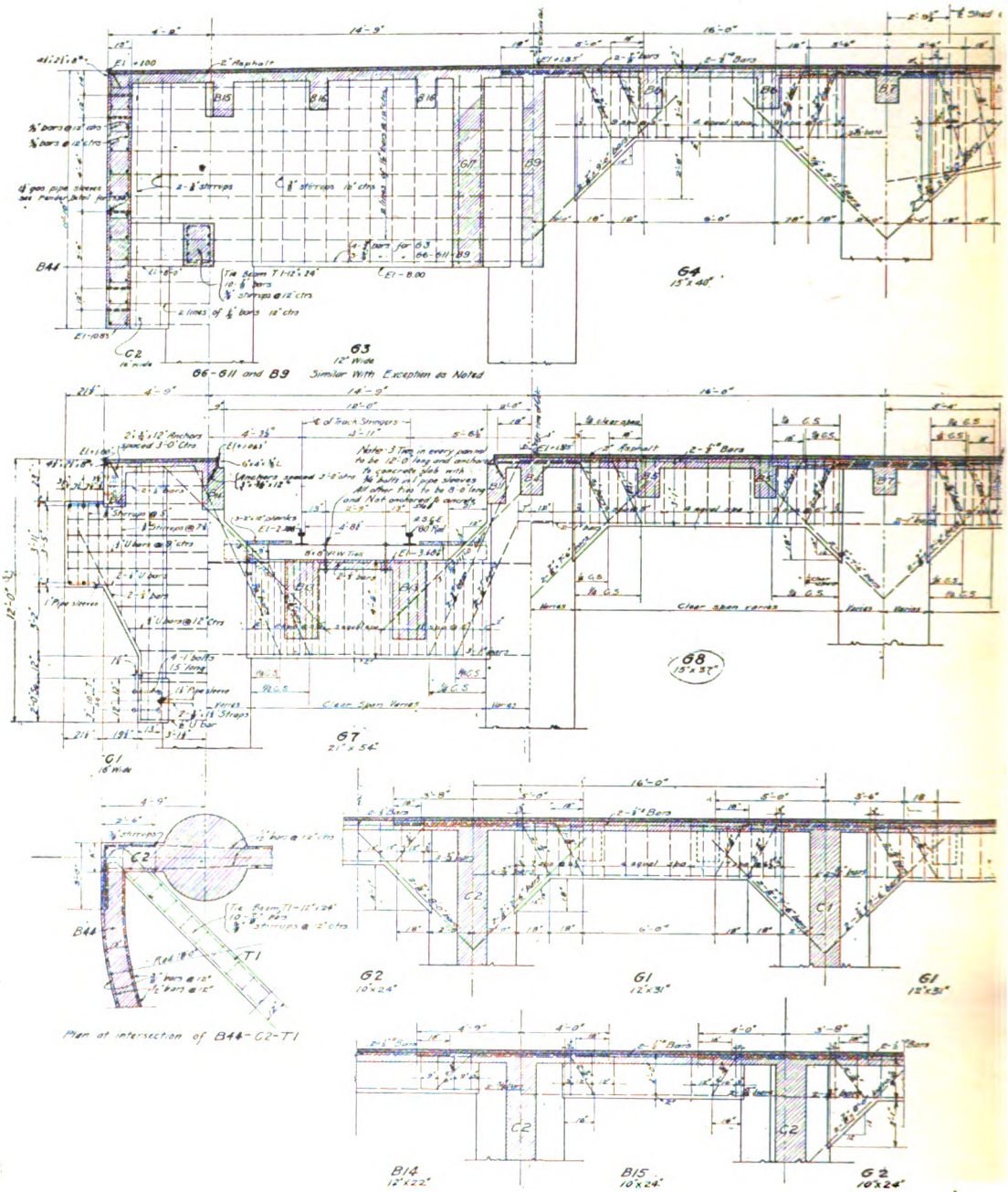
beam and slab type, the girders running at right angles to the axis of the pier and the beams framing in at the cylinders and at the third points of the girder spans. The deck is designed for a live load of 500 lb. per sq. ft. over the cargo space and the driveway. The deck system under the railroad tracks is designed to carry a 75-ton switch engine followed by a uniform load of 5000 lb. per ft. of track, both increased 50% to provide for impact. The deck slab under the flush track permits of its being ballasted, but on the depressed track side the ties rest on a longitudinal beam under each rail, the beams framing into depressed girders on the lines of the cylinders. The depressed track extends the entire length of the pier, but the flush track ends at the first cargo incline.

The typical main girders are 15 in. wide by 37 in. deep, the main reinforcement consisting of three 1 in. and two ¾-in. square bars. The typical beams are 12 in. wide, 19 and 21 in. deep, the shallow beams being reinforced with four ¾-in. and one ⅝-in. bars and the deeper beams with five ¾-in. bars. In all beams and girders an equal amount of reinforcement is provided in the top over the supports and in the bottom in the centre of the span, and the shear is provided for by bending up a part of the bottom bars



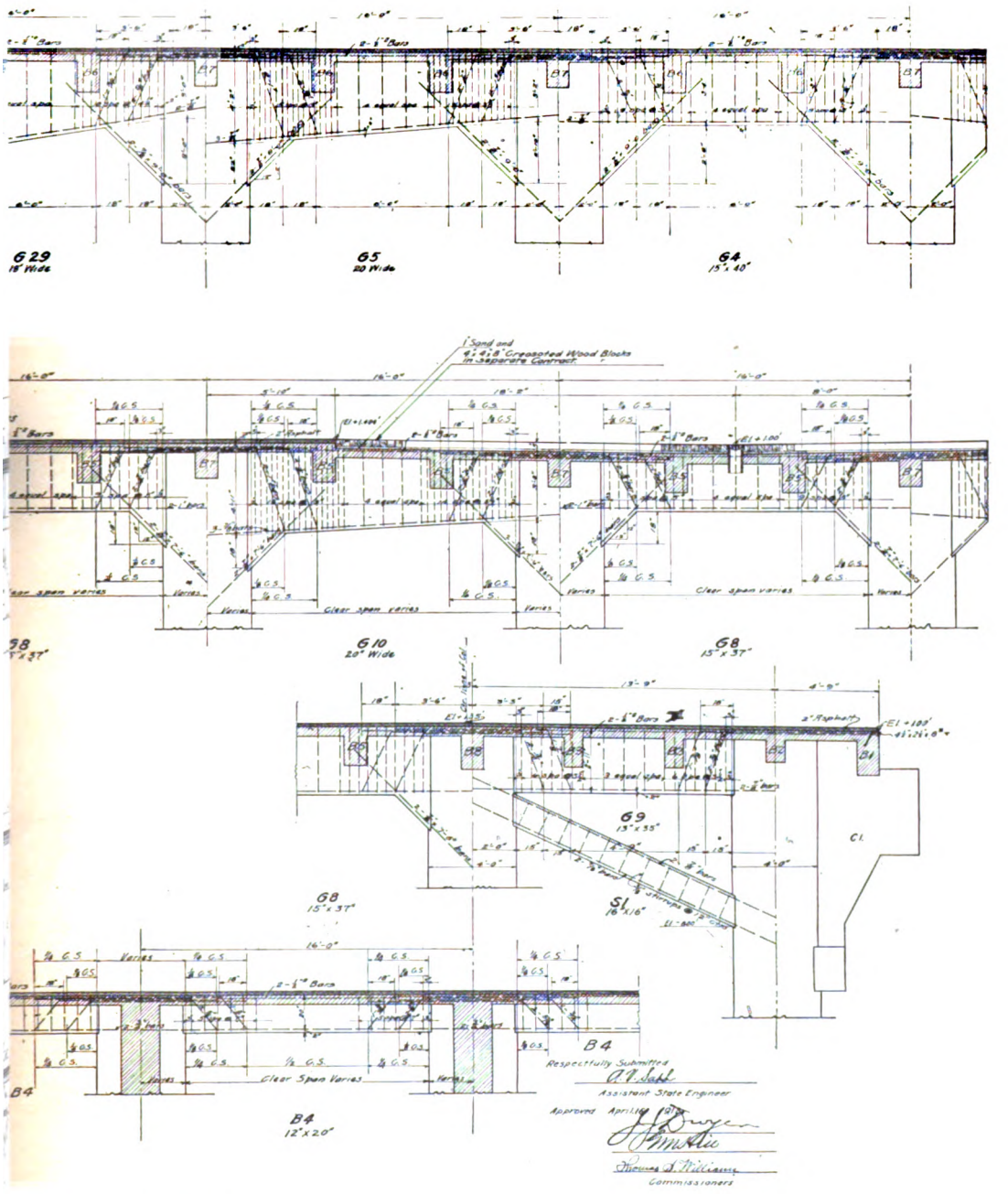
ELEVATION, PIER TWENTY-EIGHT.

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



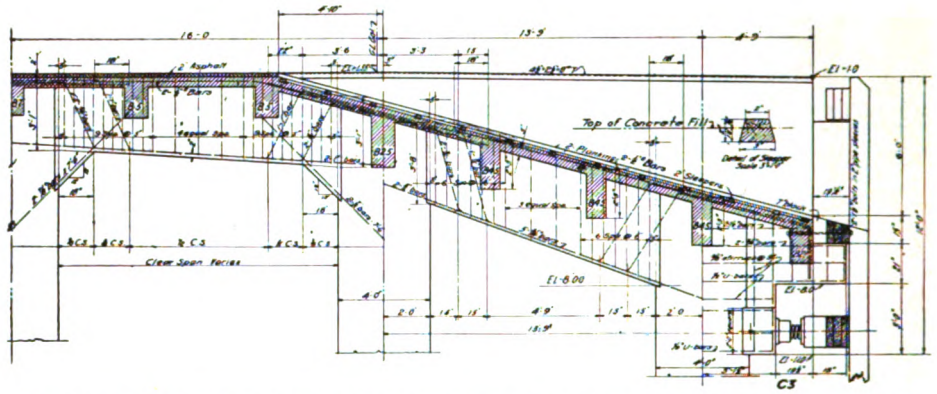
DETAILS OF REINFORCED

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



NCRETE FLOOR SYSTEM.

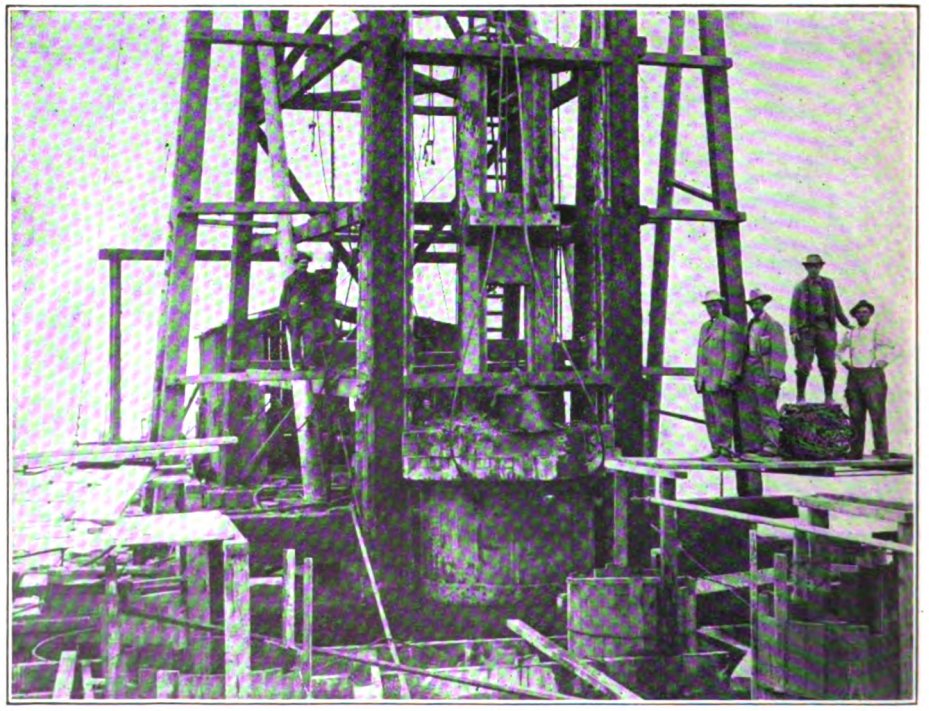
Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from
UNIVERSITY OF ILLINOIS AT
URBANA-CHAMPAIGN



DETAIL OF REINFORCED-CONCRETE FLOOR, SHOWING SECTION THROUGH UNLOADING INCLINE.

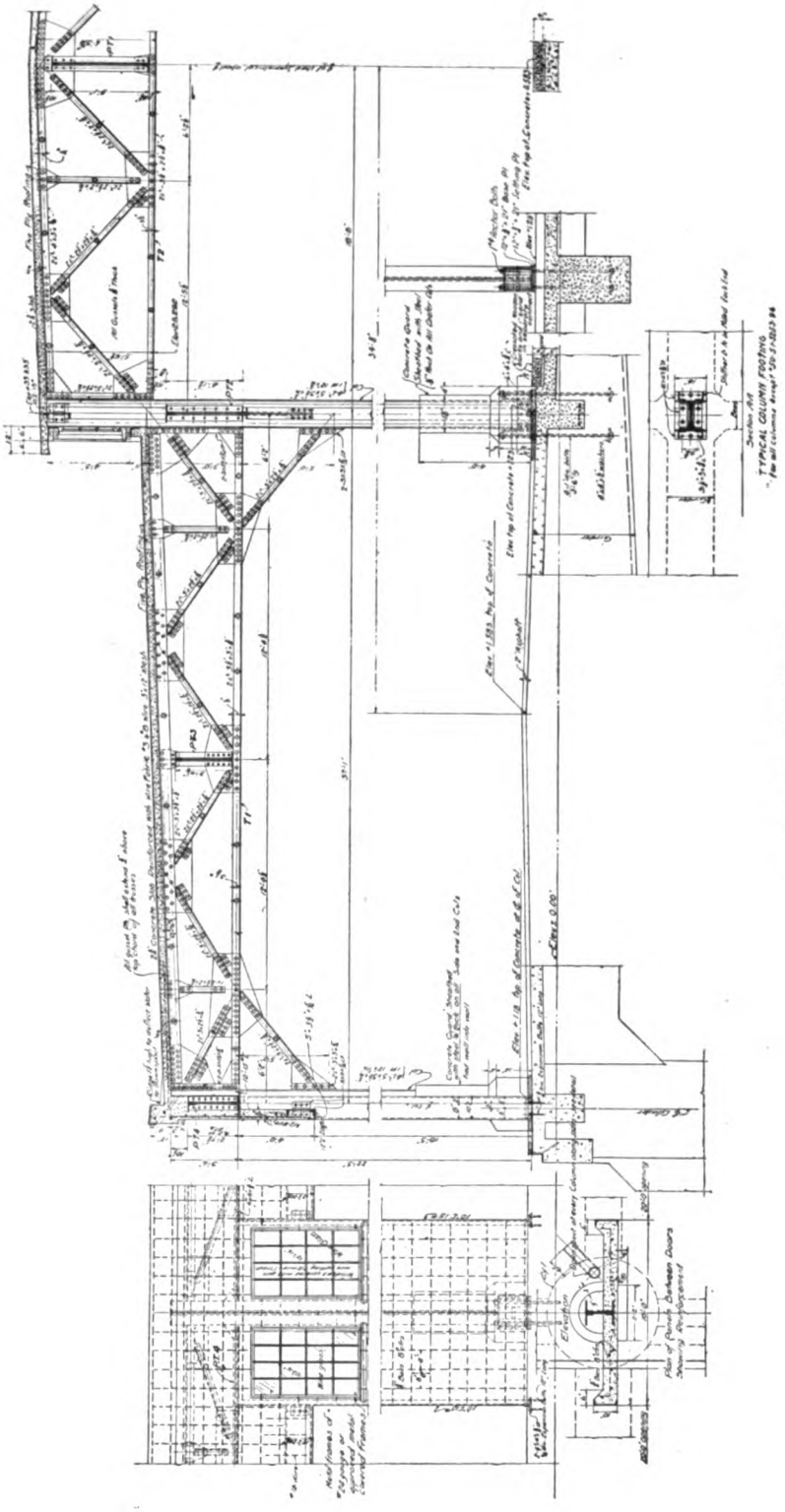
and by the use of stirrups. The deck slab is 5 in. thick and is reinforced with ⅜-in. bars spaced 6½ in. apart with 3 ⅜-in. distributing bars in each panel.

The girders under the depressed track are 21 in. wide and 54 in. deep and are reinforced with three 1-in. and four ⅞-in. bars. The girders under the flush track are 24 in. wide and taper in depth from 39 in. at the inner end to 90 in. at the outer end. The main reenforcement consists of five 1-in. bars and three ⅞-in. bars. The longitudinal track beams are 18 by 43 in. and



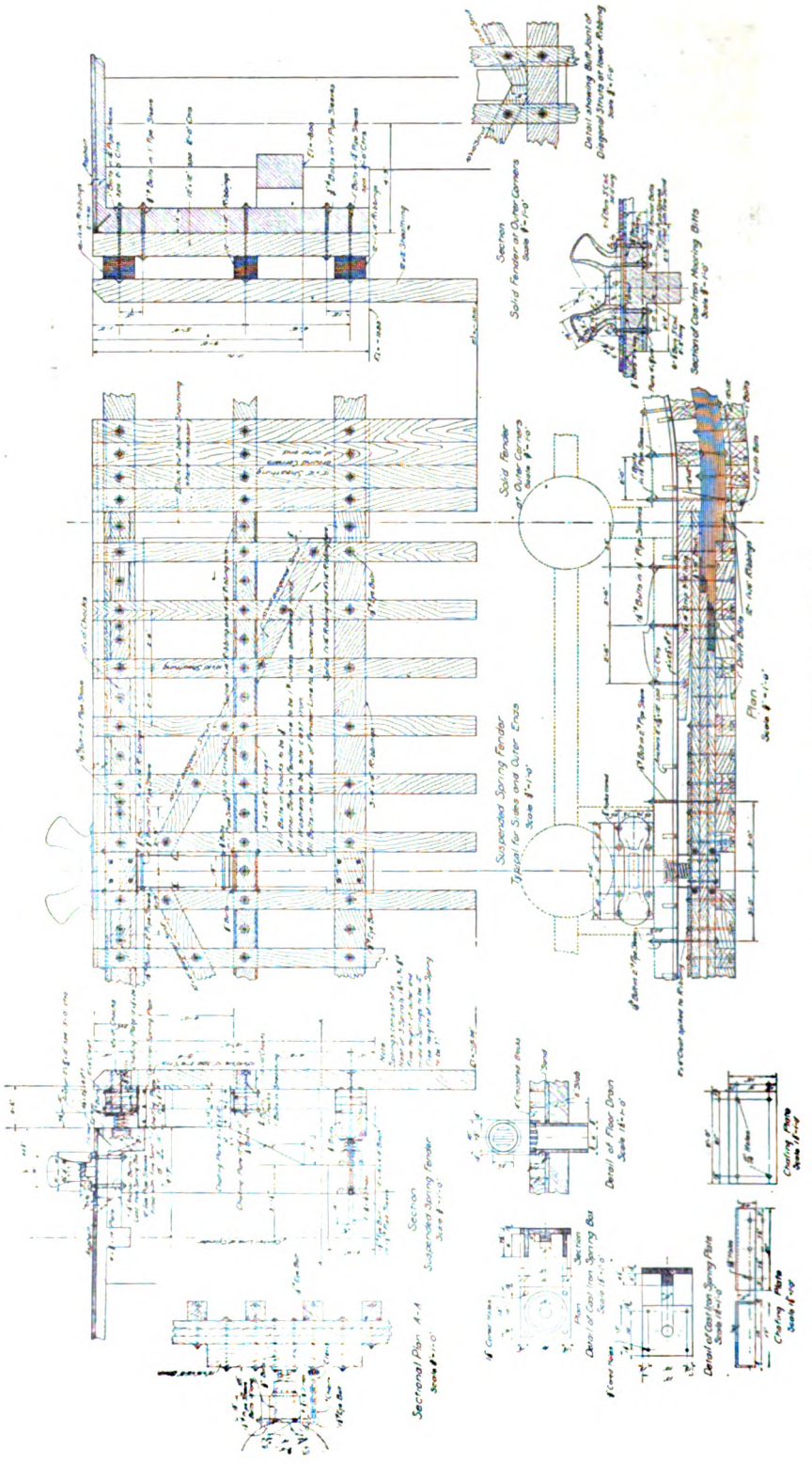
DRIVING STEEL CAISSON.

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



TYPICAL BAY, PIER No. 28.

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



DETAILS OF FENDER LINE PIER No. 28.

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

are reinforced with five 7/8-in. bars.

The driveway which is in the centre of the pier and is 36 ft. 4 in. wide, is paved with creosoted Douglas fir blocks laid on 1-in. sand cushion and grouted with asphalt. The cargo space and the spaces outside the tracks are paved with sheet asphalt 2 in. thick. The flush track is paved over the ballast with 4 in. of bituminous rock pavement.

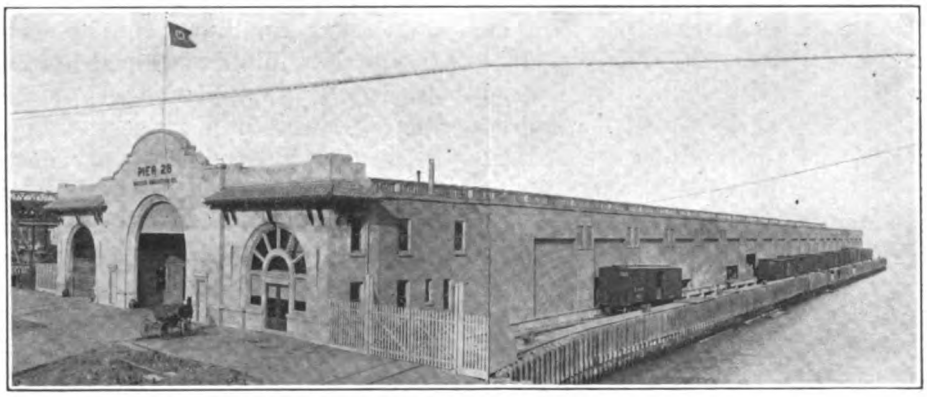
Pier Shed

The pier shed is 112 ft. 10 in. wide outside and 658 ft. in length. It is a steel frame structure with reinforced concrete walls and roof. The columns are in four rows, the two inner rows being at the edges of the driveway, and the centre spans of the trusses are raised to form the frame-work for a monitor extending the entire length of the building. The bents of the shed are 30 ft. apart and are connected by seven lines of purlin trusses. Ten-inch channel rafters support the 2¾ in. reinforced concrete roof slab, which is covered with a five-ply felt, asphalt and gravel roof. The roof slopes ½-in. per foot and is drained through the deck of the pier by means of down spouts at the outside columns. The side walls of the shed are 6 in. thick and there is a door 20 ft. wide by 19 ft. 6 in. high in each bay. The two windows in each wall panel and the continuous windows and louvres in the monitor furnish ample light and ventilation.

The door openings are each closed by a Kinnear steel rolling door operated from inside the shed by means of a hand chain. On one side of the main entrance in the front of the pier shed is a two-story office, and on the other side is a waiting room which is used in handling the Company's large passenger business. Following the plan adopted for the entire group of piers along this part of the water front, a modified Mission type of architecture has been used in treating the front of the shed. The heavy cornice is covered with Mission tile, and the decorative panels are of shattered lustre tile.

Suspended Fender

In an endeavor to avoid the large maintenance expense of the ordinary driven pile fender line, a new type of suspended fender was developed for use on the group of piers of which pier 28 is one. The fender consists of a system of vertical sheathing supported by three lines of ribbing, the whole suspended from reinforced concrete cantilevers bracketed out from the outside rows of cylinders. Triple car springs



EXTERIOR PIER 28.

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

are placed behind the upper and lower lines of ribbing and all of the lumber with the exception of the sheathing and chocks, against which the vessels chafe, is creosoted.

The construction of pier 28 was begun August 23, 1912, and it was completed and accepted September 4, 1913. The cost was $460,000 or approximately $4.50 per sq. ft. of deck. The engineering department of the Board of State Harbor Commissioners is in charge of Jerome Newman, chief engineer: Carl Uhlig and Frank G. White are assistant engineers and H. M. Kebby is chief inspector. The contractors for pier 28 were the San Francisco Bridge Company.

Creosoting Douglas Fir

By M. J. FALKENBURG, M. S.*

CONSIDERING the recent growth and importance of the creosoting industry in the Pacific Northwest, some general information regarding it may be of interest to the engineering profession.

There are at present six important treating plants in Washington and Oregon, with a total capacity, expressed in standard piling, of considerably over a half million lineal feet per month, nearly three times the total possible output of three years ago.

It is noteworthy with this greater capacity of production that all of the plants are relatively as busy now as at that time. The increased consumption has been by pier and wharf construction, due to natural industrial development on the Pacific coast, and to preparations for the increased traffic expected to result from the opening of the Panama canal. A great deal of creosoted material has been used at the Isthmus itself.

Up to the present time a large percentage of the creosoted material produced here has gone into marine structures, but highway engineers are now looking more favorably upon creosoted Douglas fir paving blocks, and many miles of this surfacing material have been laid in the past two years. The railroads are turning more and more to the use of creosoted bridge timbers and ties, and some export trade is being developed. The home of the Douglas fir, the monarch of structural timbers, is the logical location for a great wood preserving industry.

Forest products have been used from the earliest ages for structural purposes, but the rapid decay of wood under certain conditions and its destruction by low forms of animal life under others, have prevented, or at least limited, its use in many cases. Applied science in the form of the chemical engineer is overcoming these destructive agents by using various preservatives.

The causes of wood destruction may be briefly included in two general classes:

1. Marine wood borers.

*Consulting Chemist, Falkenburg & Laucks, Consulting, Analytical, Inspecting Engineers and Chemists, Seattle, Washington.

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

2. Fungi, bacteria, micro-organisms, and insects.

Almost invariably the marine wood borers are confined to salt water. Wooden structures in Pacific coast waters are subject to serious damage from two genera of mollusks—teredo and xylotrya; and three of crustaceans —limnoria, chelura, and sphaeroma. Xylotrya are similar in action to teredo, and the results of chelura and sphaeroma resemble that of limnoria.

Wood structures so placed as to get heat, light, and moisture are favorably situated for the action of the destroying agencies of the second general class. Dry rot, the result of fungus growths, and insects destroy wood kept in dry air.

Experience indicates that the most satisfactory way to overcome the destructive agents is to impregnate the material with a lasting preservative. The substances generally used in this country are creosote oil and zinc chloride. Other preservatives such as copper sulphate and mercuric chloride are sometimes used. In marine structures creosote is almost universally used, due to the fact that salts have a tendency to leach out.

The principle involved in preserving wood is to first sterilize it and then treat it with an antiseptic substance, which either kills the destroying forms of life which attack the wood, or drives them away from it on their approach. The wood is either completely permeated with the antiseptic substance used, or the outside shell and ends are saturated with it to a sufficient depth to make it impervious to the entrance of the destroying agents that attack it.

In creosoting, timber is sterilized by subjecting it to a temperature ranging from the boiling point of water up to 375°F., depending on the process, the wood meanwhile being submerged in a bath of creosote oil, or surrounded by live steam. This step in the treatment also serves to soften the wood fibre, and make it easily susceptible to the penetration of the oil.

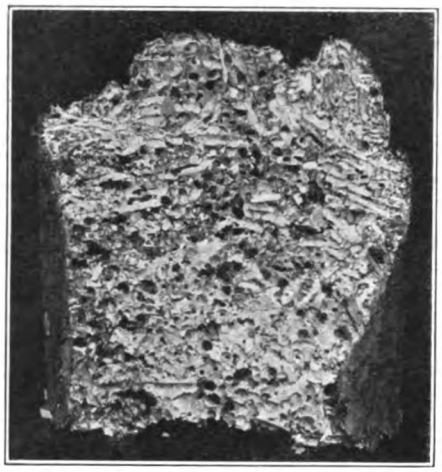
The injection of the oil into the wood is accomplished by heat and pressure applied in various manners according to the process and mechanical equipment of the plant. The effectiveness of the treatment depends upon the completeness of the sterilization of the wood, the antiseptic ingredients in the oil, the retention of preservative, depending on whether the preservative will evaporate or leach out, the depth to which it penetrates the wood, and the protection of the wood after creosoting from cuts or abrasions, which open up untreated portions of it.

There are at present three distinct processes used in creosoting Douglas fir in the Pacific Northwest:

1. The 'boiling' process.
2. The 'steam and vacuum' process.
3. The 'Rueping' process.

THREE TEREDO, EACH ABOUT 12 INCHES LONG.

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



SECTION OF PILE EATEN BY TEREDO.

The 'boiling' and the 'steam and vacuum' processes have different means for accomplishing the same ends. The 'Rueping' process is a special patented process used at present exclusively in the treating of railway ties. The 'boiling' process is used by five of the plants in the Northwest for treating Douglas fir.

In all processes the treatment is carried out in long horizontal steel cylinders capable of standing severe working pressures and temperatures. The timber is loaded on rack cars specially designed for the purpose and run into the cylinders or retorts. The cylinders vary from 5½ to 8 ft. in diameter and from 75 to 150 ft. in length at the different plants. They are equipped with pressure gauges and thermometers, usually of the self-recording style, for careful observance and record of the treating. They are connected with storage tanks for filling and special smaller tanks for close measurement of the oil injected into the wood during pressure.

There are two distinct stages in the process of treating timber with creosote oil:

1. The seasoning or sterilizing period.
2. The pressing or impregnating period.

The seasoning is accomplished either by immersion in hot creosote oil, or by steaming and vacuum, according to the process involved. This step also serves to sterilize the timber and soften the wood fibre, thereby making it susceptible to the entrance of the oil.

In the boiling process, the temperature of the oil is allowed gradually to rise to 225°F. and the wood is considered to be seasoned when no more than a certain small amount of water per cubic foot of wood distills over as measured in the condensers. The hot oil bath is similar in effect on the wood to dry heat.

In the steam and vacuum process, live steam at from 90 to 110 lb. pressure is introduced into the treating cylinder and is allowed to remain for several hours during which time the temperature attained is often as high as 375°F. After this the steam is blown off and a vacuum of 27 in. is obtained by pumps to remove the water from the wood.

In both processes, after the seasoning period the retort is completely filled with oil, from the storage tanks connected with it. These are then cut off, and a measured quantity of oil is pressed into the wood from the measuring tank. The amount of oil required by the wood in the cylinder is determined by actually calculating the number of cubic feet of wood in the retort and multiplying this by the weight of oil per cubic foot specified. Pressures of from 150 to 160 lb. per square inch are used in both processes for forcing the oil into the wood. If all of the oil has not been pressed in when the maximum allowable pressure is obtained, the pressure is held constant at that

Generated on 2024-09-30 00:35 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

point until the proper amount of oil is absorbed.

The 'Rueping' process is based upon the principle that it is not commercially economical to use a greater amount of oil in treating wood than is necessary to preserve it for the time that the wood would naturally retain its structural strength if so situated as not to be subject to the agents causing its decay. The process is limited in its application to sawed material, and at present, so far as treatment of Douglas fir is concerned, is applied only to railroad ties.

In the 'Rueping' process sterilization and seasoning are accomplished in the same manner as usual. The cylinder is then drained of all oil, and air is forced into it until certain pressure is attained. With this pressure held constant, oil is pumped into the cylinder until it is full, air being allowed to escape in the meanwhile to maintain the uniformity of pressure.

The contents of the cylinder are then oil and wood saturated with air at the same pressure. The connection with the storage tank is then closed and oil is forced into the cylinder from the measuring tank in the usual manner until the wood has absorbed the requisite quantity. During this period the air in the wood cells is further compressed, allowing complete permeation of the oil. The pressure is then gradually increased and the oil drawn from the cylinder. The air in the meanwhile expands, forcing out the excess of oil, which continues to seep out of the ties for quite a long time. The final extraction of the excess of oil from the wood is further assisted by the application of vacuum for a short period of time. The 'Rueping' method of wood preservation is often referred to as the 'empty cell' process.

It is a well known fact that sufficiently high temperatures for appreciable lengths of time in dry air or a hot oil bath (its equivalent), or in live steam, are detrimental to the strength of structural timbers, their effect being to break down the wood fibre and cells. High pressures and low vacuums also have deteriorating effects if continued for sufficiently great lengths of time. Heat applied too suddenly or too rapidly causes checking and bursting of timber.

The material used in creosoting should be the best of its kind obtainable. It would be poor economy to use a grade of lumber of low structural quality for creosoting, when it is taken into account that a good grade can be obtained for but a slightly higher cost, and that the cost of creosoting in either case is the same, and nearly twice as much as for the lumber in the case of a standard 12-lb. treatment.

Considering the variable quantities which enter into creosoting, both from the nature of the untreated material, the sources of the oil, and the mechanical difficulties of the manufacturing, it is necessary to give careful supervision and inspection to every stage connected with the industry, especially

SECTION OF PILE SHOWING RESULT OF ATTACK BY LIMNORIA.

Generated on 2024-09-30 00:37 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

to prevent the use of improper materials and the exceeding of the limits of temperature, pressure, and vacuum beyond which serious damage occurs.

Certain physical defects in timber are covered up by creosoting, and others are greatly magnified by the process, which necessitates practical experience in passing upon lumber or timber to be used in creosoting. The ordinary lumber grader will accept material which cannot be creosoted with success, and this often works a hardship upon the treating companies, as they have to purchase lumber upon the standard grades and frequently a considerable percentage of such lumber is not suitable for creosoting. A special grade of Douglas fir, known as 'lumber for creosoting,' would be advantageous. 'No. 1 common selected' is the best of the present standard grades to specify, as this grade leaves considerable discretion to the inspector.

In spite of the difficulties that enter into creosoting, both from the natural characteristics and properties of the materials used, and the delicacy of manipulation required in manufacturing, good serviceable creosoted Douglas fir is obtainable at prices that make it an economical and highly desirable structural material that is adapted for many purposes.

Effects of Faulting in Oilfields

By DORSEY HAGER*

THERE are few subjects about which less is known than faulting in oilfields. The writer herein presents a few notes that may prove of interest.

Definition of Faulting.—By faulting is meant any break or dislocation of the continuity of the strata making up the earth's crust.

Cause of Faulting.—Faulting results from the folding and fracturing of the strata or formation making up the earth's crust. As the earth shrinks, due to internal cooling and to gravitative forces, the surface is folded or wrinkled. When the folding is carried beyond the elastic limit of the strata, and the strata cannot bend any further, fractures or breaks occur. The intensity of such fracturing varies greatly. In many places faults merge into folds, and folds run into faults, varying with the strength of the strata.

Classes of Faults.—There are two main classes of faults, namely: (1) normal faults, and (2) reversed faults. A normal fault is shown in Fig. 1; a reversed fault in Fig. 2. The parts of faults are shown in the figures. The definitions follow.

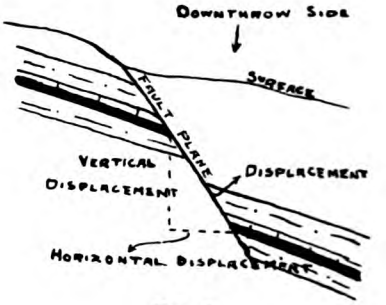


FIG. 1.

*Geological Engineer, Title Insurance Bdg., Los Angeles, California.

Generated on 2024-09-30 00:35 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

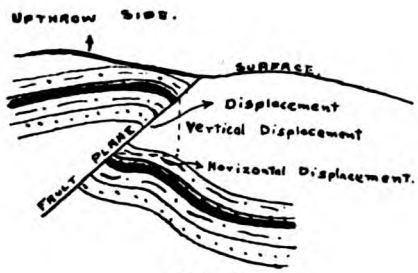


Fig. 2.

Fault Plane.—The plane along which faulting occurs.

Displacement.—The distance the beds have been dislocated.

Vertical Displacement.—The vertical drop or upthrust of the beds.

Horizontal Displacement.—The horizontal movement of the beds.

'Upthrow' side is the side of the broken strata that has been thrust over the lower.

'Downthrow' side is the side of the broken strata that has been carried down below its normal position.

Other terms like 'foot-wall' and 'hanging wall' are used in mining, but not in oilfields.

Normal faulting covers faulting that results from the sagging or dropping of one stratum upon another, due to gravitative forces. Reversed faulting covers all faulting that results from the thrusting or forcing of one stratum over another, due to compression.

Another classification, based on directions that faults take, is: (1) strike faults, and (2) dip faults. Strike faults parallel the axes of disturbances and of folds. Dip faults theoretically occur at right angles to the strike. They are classed as dip faults until they make a 45° angle with the strata. Over that angle they become strike faults. Strike and dip faults are of either normal or reversed types.

Generalizations on Faults.—Strike faults are generally much longer than dip faults, sometimes running for many miles. Dip faults are generally local, and extend for hundreds of feet or fractions of miles. Strike faults are often of great length. Some of these faults are known to be over 200 miles long. The great faults like the San Andreas and the Whitney faults are of this type. Normal faults generally occur in or near synclines, or on the flanks of least inclination on anticlines, though sometimes on the axes of anticlines. Reversed faults generally occur at the anticlinal axes, where thrusting is more pronounced.

Effects of Faulting.—Faulting may be favorable, unfavorable, or neutral in its effect on oilfields.

The favorable effects of faults are that they (1) assist in migration of petroleum; (2) form good reservoirs; and (3) lessen depth to oil.

The unfavorable effects of faulting are that they (1) destroy reservoirs, allowing escape of petroleum; (2) deepen sands; (3) allow intrusions to come up; (4) allow entrance of water into oil formations; and (5) complicate drilling.

The neutral effects of faults are that they (1) disappear at shallow depths; and (2) occur in synclines.

Faulting assists in migration: (*a*) by opening channels of communication between dry, porous strata and strata fully saturated with petroleum (see Fig. 3); (*b*) by allowing infiltration

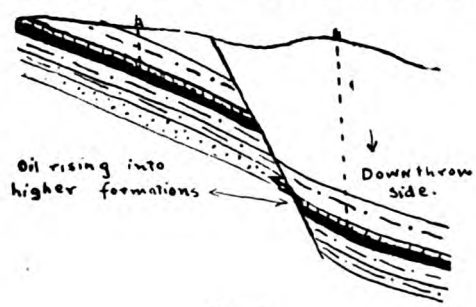


Fig. 3.

Generated on 2024-09-30 00:38 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

of water into lower strata, thus driving oil to higher strata.

If the strata overlying the oil sand are sealed so that oil cannot escape, it may accumulate on the upthrown side, of the fault or on the down throw side, in close proximity to the fault plane. The upthrow side of a fault really acts as an anticline, so far as accumulation is concerned.

Faulting forms good reservoirs: (*a*) by causing crushed zones that are porous and thus afford good storage for oil. This condition is true at Santa Maria, California, and also in the Puente Hills. (*b*) by causing open fractures that hold petroleum, as occurs at Florence, Colorado.

Faulting lessens drilling depths to petroleum by bringing more deeply buried formations closer to the surface. (See Fig. 4).

FIG. 4.

Faulting destroys reservoirs (*a*) by exposing reservoirs to erosion, and (*b*) by breaking up favorable anticlinal conditions. In the first case, the rising or falling of one side of an arch exposes the oil sands to erosion and also allows any oil to escape. (See Fig. 5 and 6).

In the second case, the oil travels up the fault plane, and may migrate to other sands or escape at the surface, leaving with heavy oils a heavy asphalt residue. Such asphalt beds are common in California. The Upper Ojai valley,

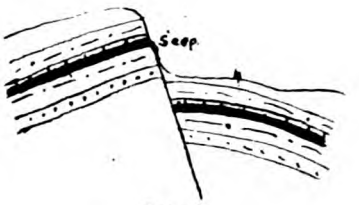


FIG. 5.

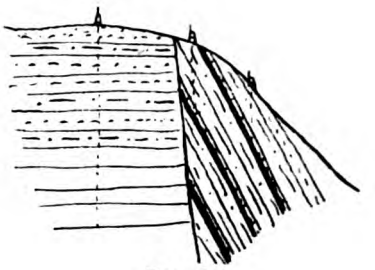


FIG. 6.

Ventura county, is a notable example. The asphaltum in many cases seals in the remaining oil, and thus helps greatly in conserving the oil. If the petroleum migrates to other sands, concentration may be lacking and thus no good paying oil found. Faults in many cases deepen sands just as in other cases they make them shallower. (See Fig. 3).

Along many fault lines one will find intrusions that in some cases adversely affect the sands and shales by burning out their petroleum content, though intrusions in places seemingly have no effect. Intrusions may indeed assist in distilling oil from shales and be beneficial rather than detrimental.

Where water sands are present, as is nearly always the case, water may obtain access along the fault plane to the oil sands and drive the oil from one stratum to a number, thus dissipating the oil and flooding the field with water. In such cases the oil naturally rises higher in the formations, and if conditions are favorable, valuable accumulations may occur higher up, as discussed before.

Faults complicate drilling (*a*) by

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

causing cavities that in some fields are hard to manage, as water, and sometimes running sands, fill them; (*b*) by making it difficult to keep accurate logs. This latter is especially true where faulting is intense, as the logs of one well are no criterion for a neighboring well. At Whittier, faulting has made correlations difficult.

Faults may have no effect on oil sands at all where such faults disappear with depth (see Fig. 7), or where

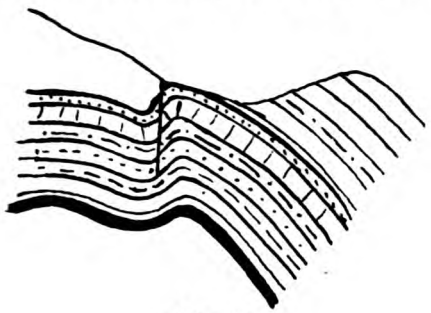


FIG. 7.

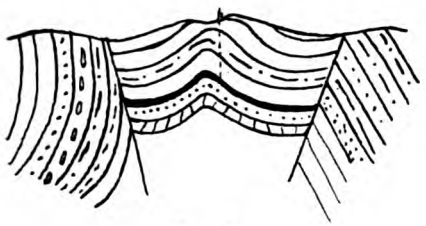


FIG. 8.

they occur in synclines (see Fig. 8). The first condition is common with small faults that may appear near the surface but disappear within a few hundred feet.

Where faults occur in synclines, no effect is evident, as the anticlinal relations are just as favorable as before.

Mapping of Faults.—In Fig. 9 a fault is shown on a geological map. A cross-section of the same is also shown at the right hand side of the figure. Fig.

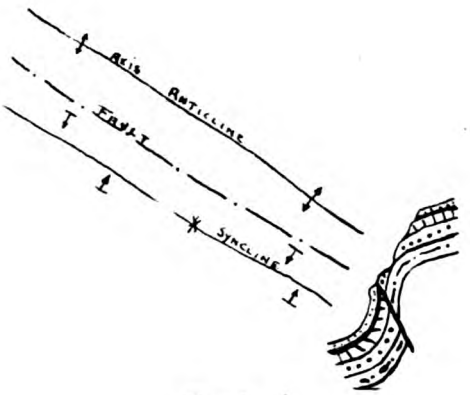


FIG. 9.

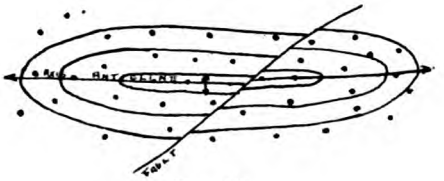


FIG. 10.

10 shows the method of expressing faults by underground contours.

Results of Underground Mapping.—In an open region like Ventura county, faults are easily seen, but in the Coyote Hills district and like fields, underground contouring and careful cross-sectioning alone will show faulting. Faults often explain differences in specific gravities, in neighboring wells, differences in the thicknesses of sands, and the differences in ages of formations that occur at the same elevation.

Conclusion

Faults occur in most oilfields; in some cases they are beneficial, in some harmful, in others neutral. But only a careful study of each field can determine the effect. To say that a field is faulted by no means condemns it, as many of our best fields have faults running through them.

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Pumping Plant for Reclamation District No. 1500*

THERE appeared in the October 1913 issue of this journal, a very complete description of the Sutter Basin reclamation project, dealing with the general scheme adopted for the reclaiming of the district between the Sacramento and Feather rivers commonly known as 'Sutter Basin', comprising an area of approximately 68,000 acres.

The scheme of reclamation outlined wsa in general accordance with the By-pass Channel scheme recommended by the Debris Commission to the U. S. Government described in the April 1912 issue of this journal, modified by the State Reclamation Board. This called for a by-pass channel through the central portion of the district, thus dividing the lands comprising Sutter Basin into two sections. Since the above article was written the Reclamation Board has agreed to locate this by-pass channel along the eastern boundary of the lands as shown in Fig. 1. This change has simplified the question of drainage considerably and also preserves the rich lands lying in the trough.

Reference was made in the above article to two pumping plants which would be required under the old scheme, one to serve each half of the district. The change in the location of the by-pass channel allows of the substitution of one large plant to care for the whole district and it is the purpose of this article to describe this plant.

This plant is probably the largest centrifugal pumping plant in the United States, if not in the world, having a total capacity of 676,000,000 gallons of water per day, requiring 5000 hp. for its operation. The plant is expected to operate from thirty to sixty days during the normal year, during which period the plant may be run partly or as a whole, depending upon the amount of water to be handled. The larger part of this will be rain

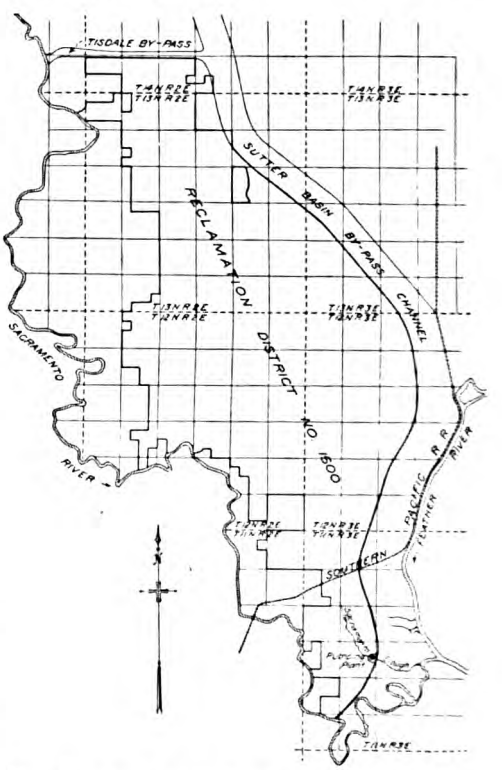


FIG. 1. MAP OF DISTRICT, SHOWING POSITION OF BY-PASS CHANNEL AND PUMPING PLANT.

*From data furnished by Chas. C. Moore & Co., San Francisco.

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

water with a certain amount of seepage through the levees. On account of some of the adjacent lands not being protected by levees, the Reclamation Board will not allow the Sutter Basin levees to be closed before July 15, 1915, which will mean that the pumping plant will not be operated until the water begins to go down this coming season, but after the coming season the pumping plant is designed to keep the land clear of water to a point below ground level.

The pumping plant will be located at the extreme south end of the district on Sacramento slough about 1½ miles above its confluence with the Sacramento river, approximately 22 miles from Sacramento city, via the Sacramento river. The location of this plant is shown in Fig. 1.

Fig. 2 shows the general layout of the plant with reference to the surrounding district, from which it will be noted that the Sacramento slough is used for a portion of its length for the main drainage canal. At the proposed location of the plant the slough takes a turn, discharging its waters into Sutter Basin by-pass. A timber piling bulkhead is built at the outer and inner toe of the levee at this point, thus forming a suction forebay. The pumping plant is located with its long side parallel to the canal at this point, the pumps taking their suction from this canal and discharging same through the levee into Sutter Basin by-pass.

The building is of extremely heavy construction, being designed so that when machinery is installed, the total weight of the building and machinery will overcome the tendency of the structure to float at high water. The building is 99 ft. 6 in. long by 25 ft. 6 in. wide, inside measurements, standing 36 ft. 6 in. from main floor level to roof. The building is supported on reinforced piles spaced approximately 5 ft. centres longitudinally and 4 ft. centres crosswise of the building. Built upon this is the floor, 4 ft. thick over the entire area with walls 4 ft. 6 in. at floor line, tapering to 30 in. at elevation 42, which is high water elevation, and from that point tapering off to 15 in. at roof-line. In addition to the

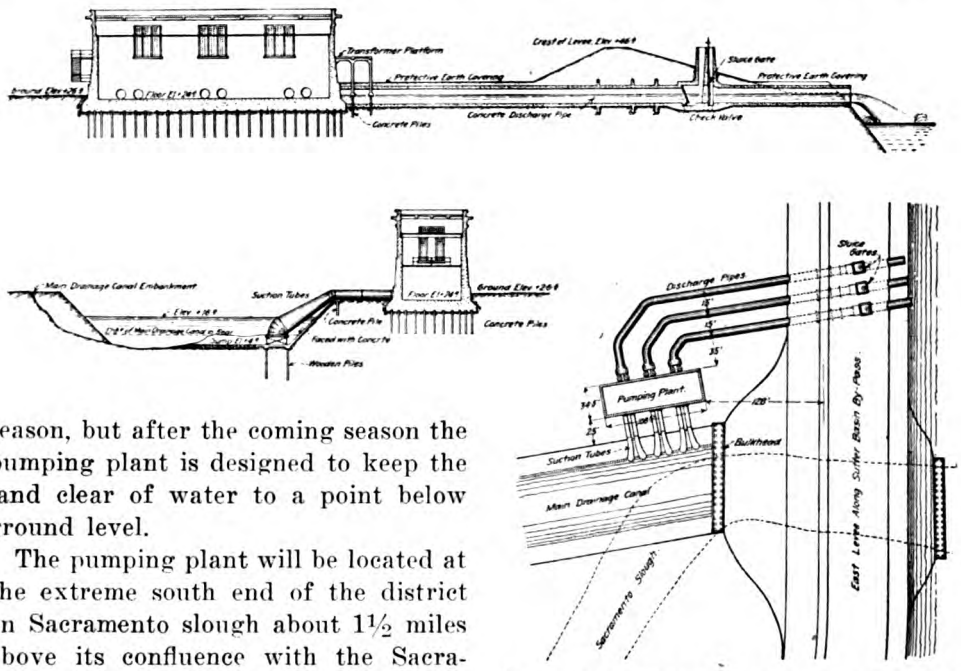


FIG. 2. PLAN AND ELEVATION OF PUMPING PLANT SHOWING SUCTION AND DISCHARGE CONNECTIONS.

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

extremely heavy walls there are six buttresses on the north and south walls and two on the east and west walls. The ground-level is 26 ft. 6 in., U. S. E. D., the main-floor level 24 ft. The portion of the building below 42 ft. is entirely without openings, windows and doors being above this level, which brings them above high-water mark. The main entrance into the building is at elevation 42, there being a platform built up along the west end of building with steel stairs running up to it from ground elevation.

Running at this level through the length of the building is a mezzanine platform built of reinforced concrete, access to main-floor level being obtained by steel stairs. At the east end of the building, at same level, is a switch gallery, the switchboard being placed on the main floor immediately below. An operating platform will run along the south wall just underneath the mezzanine floor, constructed entirely of structural iron and checkered floor plating so that it may be easily removed to give access to machinery. The roof of the building is a flat reinforced concrete slab supported on 20-in. I-beams, the roof being finished with an impervious coat of asphalt and gravel. The building is well lighted, having three large steel frame windows approximately 12 by 14 ft. on both north and south walls and two windows in east and west walls, one of these windows being removable to admit the machinery into building.

For the handling of machinery there will be installed a 15-ton crane having a motor-driven hoist, but the bridge and trolley will be hand operated. All motions will be handled from the main floor. The motor will be a 110-volt, 3-phase, 60-cycle, variable-speed induction motor capable of raising fifteen tons at the rate of 20 ft. per minute. Bridge and trolley movements will be so geared that they can be easily operated by one man when crane is loaded to its full capacity.

A reinforced concrete platform will be built alongside the east wall of the building to support step-down transformers. The floor of this structure is just above high-water line and will be supported by concrete columns, in turn resting on reinforced concrete piles.

The suction sump will be formed by a reinforced concrete lining or slab on one bank of the canal and also a portion of the canal excavated down to elevation 3, the remaining part of suction sump being paved with cobbles. There will be three main discharge pipes passing through the levee as shown, each of which takes the discharge from two pumps. The discharge pipes are 260, 305, and 350 ft. respectively, being 6 ft. 6 in. inside diameter, designed with a flat base giving support for full diameter of pipe. These pipes are of concrete 12 in. thick, strongly reinforced both longitudinally and circumferentially. At the extreme end of discharge pipe just beyond the crown of levee there will be placed a wooden flap valve made of 8 by 8-in. timbers properly built into angle-iron framing. Just beyond the flap valve will be a valve chamber constructed of reinforced concrete built into and forming part of the discharge pipe. This valve chamber will be fitted with cast iron sluice gates approximately 60 in. wide by 84 in. high, gates to be equipped with operating stand and mechanism so that they may be operated from top of valve chamber. The valve chamber will be covered with iron grating with manhole. This valve chamber operates as a relief in discharge pipe to prevent water hammer.

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

the top of same being 45 ft. 3 in., U. S. E. D. Light trussed wooden foot bridges are to be provided from top of levee to each valve chamber, also connecting the three chambers.

The pumping plant consists of six 50-in. pumps direct connected to electric motors, each pump having a capacity of 175 second feet of water, pumping against a maximum head of approximately 29 ft., the lower limit of head being approximately 10 ft. The elevation of water in suction forebay will vary from 13 to 18 ft., U. S. E. D., and the elevation in the discharge forebay will vary from 20 to 43 ft., U. S. E. D. The static head will vary from 2 to 25 ft., with approximately 4-ft. discharge friction.

Fig. 3 and 4 show plan and elevation, respectively, of pumping plant. In order to minimize space, the pumps are placed in two rows, with the suction pipes of the pumps farthest from suction sump running under shaft between pump and motor of the unit on suction side of building. Further, the pumps are made with shells split horizontally

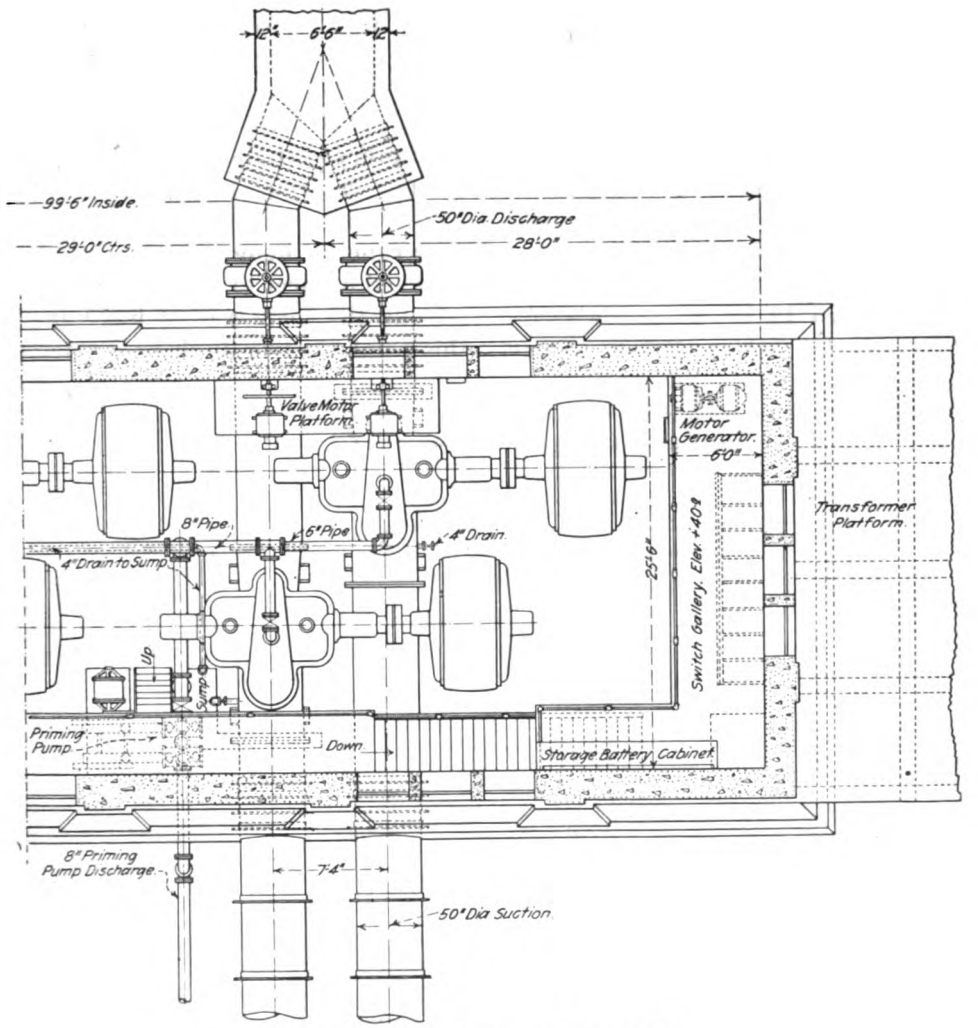


FIG. 3. HALF PLAN OF PUMPING PLANT.

Generated on 2024-09-30 00:38 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

so that no space is required for removal of runners. The centre line of pumps is 6 ft. 3 in. above floor line with the suction and discharge pipes running along floor-level. These pumps are of Platt Iron Works manufacture, of the double-suction type similar to the pumps just installed by the same company for Reclamation District No. 108. The large size of these pumps can be seen by reference to illustration.

The pumps are direct connected to General Electric motors operating at 248 r.p.m. through flexible leather link couplings. Motors are rated at 800 hp. on the basis of 40° temperature rise with 25% overload guaranteed for two hours. Pumps are so designed that the horse-power over the entire range of pumping from the lowest to the highest head only varies from 800 hp. under minimum head to 825 hp. at the maximum head, operating at constant speed.

For priming purposes there will be provided two 12 by 12-in. Platt Iron Works duplex motor driven vacuum pumps having suctions connected to the top portion of casing of all the centrifugal pumps. When priming pump and before starting same, the gate valve in the discharge line will be closed, and after priming, the pump will be started, and when up to speed gate valve will be opened.

Suction pipes are approximately 60 ft. long, running directly out through the south wall of building, a distance of 32 ft. and then dropping down with easy bends into the suction forebay, the diameter at the pumps being 50 in., tapering to a diameter of 96 in. at the lower end. These suction pipes are of ⅜-in. plate steel construction, the lower end of pipes resting on a grillage work of structural I-beams provided with proper grizzlies to prevent foreign matter entering pumps. The pumps have bottom side discharge, discharge pipe running along the floor, being constructed of steel to a point about 15 ft. beyond the north wall of building. At this point the two discharges enter one

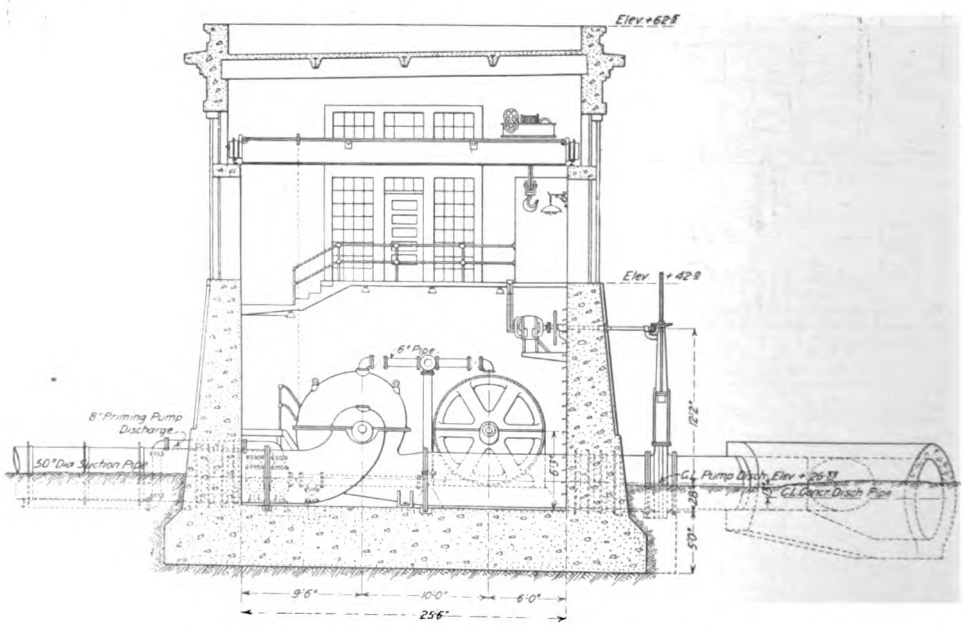


FIG. 4. SECTION ELEVATION OF PUMPING PLANT.

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

common concrete discharge pipe, each of the steel discharge pipes being 50-in. diameter and the concrete discharge pipe 6 ft. 6 in. inside diameter.

In the discharge pipes just outside of building are placed motor-operated gate valves of Chapman manufacture. The gate valves will be operated through bevel gearing from motors placed on brackets on inside wall. These valves will be designed to close safely when pump has stopped and direction of flow has reversed and velocity of water has attained a maximum which is estimated will be 25 ft. per second. They will be capable of opening and closing safely in two minutes under these conditions. The motors operating the gate valves are to be 110-volt, direct-current, series-wound motors of special design adapted for this service. Each motor with its valve is to be equipped with limit switches and also an indicator showing amount of gate opening; this indicator to be visible from operator at switchboard. The valve motors will be controlled entirely from the switchboard; the starting resistances mounted in the rear of board. The starting device is to be equipped with no voltage release and a reversing drum type controller switch. In case power goes off the valve motors will be closed by storage battery.

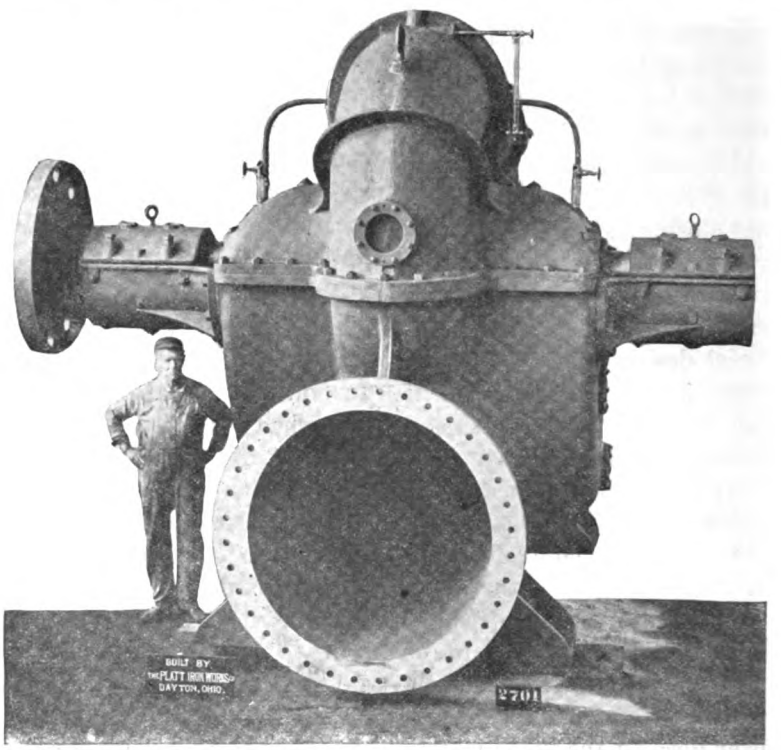
The plant is so situated that it can be served by any one of three companies, the power company running its lines to the step-down transformers immediately outside of building. From the transformers, five leads run through building walls to busses forming one 2200-volt and one 1100-volt circuit, from thence through disconnecting switches to starting and running switches and thence to motors. The starting and running switches for the motors of the main units will be 300-ampere, 2300-volt, 3-pole, single-throw, hand-operated remote control, oil brake switches with overload release automatic and no voltage release. The switches will be installed in groups of two, one starting and one running switch for each motor. The starting switches are connected to the 1100-volt circuits, and when motor is up to speed the running switches are thrown in on the 2200-volt circuit. The starting and running switches will have a mechanical interlock so that both switches cannot be closed at the same time. All of the switches are hand operated through switch rods from switchboard which is located on main floor below switch gallery.

For operation of small motors, lights, etc., there will be furnished two 25-kva. 2200/110-volt oil-cooled transformers. In addition to the above there will be furnished the necessary current transformers for the main leads into the building and for the separate motor circuits; also necessary potential transformers to furnish potential to switchboard instruments and also current for the low voltage releases. There is to be provided a 56-cell 112-volt storage battery of the chloride accumulator type to operate the gate valve motors and various electric lights. The storage battery cabinet for housing same is of concrete construction, built into building wall. In order to charge storage battery there will be furnished a 10-kva. motor generator set. A storage battery has been resorted to to operate gate valve motors in order to provide safety against loss of power. In case power goes off the line the storage battery will carry sufficient current to close the discharge gate valves.

The switchboard will consist of eight panels of blue Vermont marble

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

supported on the usual pipe stanchions. All instruments, switches, handles, gauges, etc., will have dull black enamel finish. All instruments will have circular case 8-in. diameter and will be back connected. Panel No. 1 will control the auxiliary apparatus and lights, equipped with hand-operated circuit breaker, ammeter, voltmeter, handwheel, and mounting for generator field rheostat, potential receptacles, and four lever switches. Panels No. 2 to 7 inclusive will have necessary instruments for controlling the main pump motors and valve motors, being provided with ammeter and three-way ammeter switch, general operating mechanism for rheostats for valve motors, automatic oil switches, two current transformers, and water and vacuum gauges. Panel No. 8 will be used for main station transformer panel, equipped with voltmeter, ammeter, voltmeter receptacles, ammeter switch, and engine room clock. A swinging bracket mounted on end of switchboard of panel No. 1 will have mounted on it a direct current ammeter for indicating charging and discharging current of battery. The controlling mechanism for vacuum pump motors will be placed alongside the pumps.



FIFTY-INCH PLATT IRON WORKS DOUBLE-SUCTION PUMP.

All conduits are to be furnished and placed in building walls by building contractor with wire run through so that power-plant contractor can easily install his wiring. All main power leads from running switches to centrifugal pumps to be 4-0, three-conductor, stranded, lead-covered cable varnished cambric insulation. Leads

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

from 2200-volt bus-bars to disconnecting switches and also from bus-bars to auxiliary transformers are to be ½-in. round copper bars over which is to be drawn, after bending bar circular, loom insulating material. All other wiring will be double-braid rubber covered copper wire conforming in all respects to the National electric code requirements for 600-volt service. All wires of No. 6 B. & S. gauge or larger are to be stranded cable.

All lights under mezzanine floor, valve motor platform, switch gallery platform, over storage battery cabinet, in lavatory and all other single light fixtures are to have Holoplane steel reflectors with 150-watt 'Mazda' lamps. Fixtures along the north wall will be 26-in. Mazda economy diffusers, suspended from ornamental iron brackets by links, each fixture to have five 100-watt Mazda lamps. The fixtures at main entrance will have two 100-watt Mazda lamps. The lighting circuit will be controlled from the lighting panel in wall cabinet near switchboard. The D. C. circuit will have a three-way switch at the main entrance; also on this lighting panel. In addition to the above there will be furnished two outlets with extension cords for portable lamps.

The Sound Construction & Engineering Co. are the contractors for the building and concrete discharge pipes, their work to be finished by October 1, 1914, under penalty of $500 per day, this heavy penalty being necessary on account of the importance of getting this work in shape before the winter rains. The pumping plant contract was let to Chas. C. Moore & Co., Engineers, the contract including all of the machinery inside of building, together with discharge gate valves and suction pipes. All of the electrical apparatus has been sublet by them to the General Electric Co. This part of the contract is to be finished by December 1, 1914, under the same penalty mentioned above.

The total cost of this entire work will be approximately $180,000.

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

The Compressed Air Method of Mixing and Placing Concrete*

THE compressed air method of mixing and placing concrete has been in process of evolution for ten years or more, but within the last two years has become more widely known through the larger works upon which has been used. The method was first used for tunnel lining work but has now demonstrated its economy for heavy concrete work of all kinds such as dams, retaining walls, bridges and foundations.

The mixer consists of a hollow cone with an air tight door at the top and a pipe connection at the bottom. After each batch is placed in the machine the door is closed by the small air cylinder shown, and air is admitted to the machine in such a way as to thoroughly mix the batch and discharge it through the pipe to the forms. In this way the concrete is mixed and placed without labor and with no other equipment than pipe for transporting the concrete. Within ten seconds after water has been added to the cement the concrete is in the forms at rest.

The amount of air which is required to operate the machine depends upon the length of the delivery pipe. This will also vary with the number of turns in the pipe-line; with the kind of material used for aggregate and with the vertical distance involved in the delivery. It is demonstrated, however, that for general purposes of calculation, the amount of air will not exceed 1 cu. ft. of free air compressed to 80 lb. for each lineal foot of 8-in. delivery pipe for each batch of concrete.

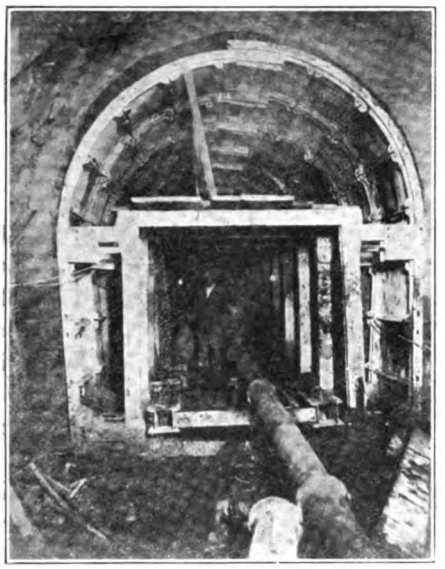
One of the first tunnels upon which this machine was used was the LaSalle Street tunnel, Chicago, where the machine was set up on the bank of the river and the pipe was extended from the machine down a shaft 35 ft. deep and then horizontally about 300 feet. Later, on the O. K. Creek Sewer tunnel at Kansas City, the machine was placed at the bottom of the shaft and the materials for concrete were dumped into the machine through a chute from the top of the shaft. The greatest distance which concrete has been delivered up to the present time was at Tallulah Falls, Ga., on a large hydro-electric development where concrete was discharged through a pipe about 1200 ft. long.

In small tunnels where the shafts are great distances apart the machine is taken into the tunnel and sunk by blasting out a place for it so that the top of the machine is low enough for the narrow gauge cars to dump into it. In this way a tunnel of any length may be concreted by using pipe about 500 ft. long and moving the machine back for each 500-ft. section of tunnel.

For concreting large railroad tunnels, the most economical way is that used by the Chicago, Burlington & Quincy Railroad on the Alkali Summit tunnel in Wyoming. The method used may be described as follows:

*From data furnished by the Concrete Mixing & Placing Co., Chicago.

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



EIGHT-INCH PIPE PASSING THROUGH TUNNEL FORMS WHICH ARE BEING MOVED FORWARD AND CARRYING CONCRETE TO FORMS BEYOND. CONCRETE CONVEYED 1200 FT. IN THIS TUNNEL, TALLULAH FALLS, GEORGIA.

The pneumatic mixer and conveyor is mounted on a standard 40-ft. flat car and bins are erected on the car which contain about 26 cubic yards of material. The cement is stored in bags under one of the bins, which slope to the centre of the car and discharge through chutes into a measuring hopper. This measuring hopper is lifted and tilted to discharge into the mixer by means of a cable operated by a small air cylinder. The pipe which conveys the concrete from the mixer to the tunnel forms, runs from the mixer under the car and up at the end to the top of the bins, which are 14 ft. above the rail, and then on an incline above the car to a point about 24 ft. above the rail where it is in a position to discharge concrete through the bulkhead of the tunnel form. This pipe may be raised and lowered to clear the braces of the tunnel forms.

It requires but four men to operate the car and the 26 yards of concrete materials which the bins hold may be mixed and placed in one hour.

On outside mass concrete construction the work at the Ontario Power Company, Niagara Falls, Ont., illustrates a great economy. On a portion of this work were three separate retaining walls; one 20 ft. below the elevation of the mixer and about 100 ft. to the west; the other two walls at an elevation of 30 ft. above the mixer and 80 ft. to the east. To concrete these walls the labor cost was 30c. per cubic yard.

In the construction of the Otis Steel Company's plant at Cleveland, Ohio, about 300 piers averaging 15 ft. in height and containing from 10 to 19 cubic yards of concrete each were placed at a cost of approximately 34½c. per cubic yard for labor. These piers were placed by blowing the concrete through a 'gooseneck' arrangement which was moved along as the work progressed and attached to the extended pipe. The 'goose-neck' was made to swing so that four piers could be filled each time the pipe was extended.

GOOSE-NECK ARRANGEMENT FOR FILLING FOUNDATION PIERS, OTIS STEEL CO., CLEVELAND, OHIO.

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Colorado Street Bridge, Pasadena, Cal.

By J. C. WRIGHT*

THE Colorado Street Bridge in Pasadena spans the Arroyo Seco connecting the west end of Colorado street with the county boulevard, which runs through the Eagle Rock valley, affording a much shorter and more scenic route for automobile travel between Pasadena and Los Angeles than was enjoyed before its completion.

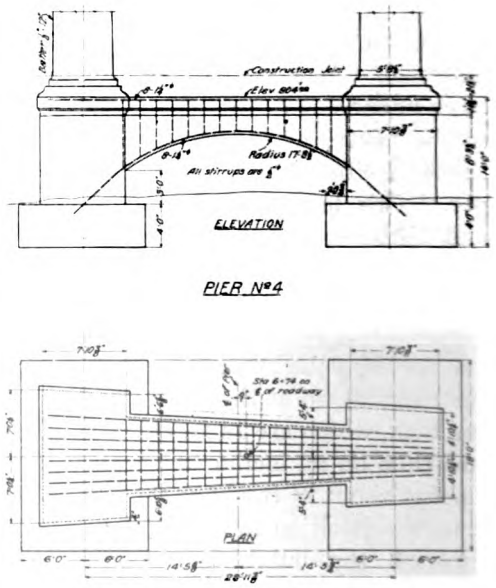
The bridge is 1468 ft. long and is built on a uniform grade of 2.655%. It has a 28 ft. clear asphalt paved roadway with 5-ft. clear cement sidewalks on both sides, which the artistic artificial stone balustrade makes a total width of 40 feet. The roadway and walks are lighted at night by electric lights on 48 ornamental cast iron lamp posts. Resting seats are built into the railings for the comfort of pedestrians.

There are fifteen parabolic arches of the open spandrel two rib type in the bridge. The arch over the main channel of the arroyo has a clear span of 210 ft. and the roadway at its crown is 165 ft. above the arroyo bed. On each side of the main arch there is an arch of 140 ft. clear span; the westerly one being joined by the three 30-ft. span arches of the west approach while the easterly one is connected with the three 30-ft. spans of the east approach with six arches of 105-ft. clear span.

There are 11,000 cubic yards of concrete and 600 tons of reinforcing steel in the completed structure. The construction work was commenced by the Mercereau Bridge & Construction Co. in July, 1912, and the Fairchild Gilmore Wilton Co. laid the asphalt pavement the first part of December, 1913. During this time there were 23100 men-days of labor spent in building the bridge.

The construction of this bridge cost the City of Pasadena and the County of Los Angeles $193,000 which, with the cost of the right of way, etc., makes a total cost of $250,000.

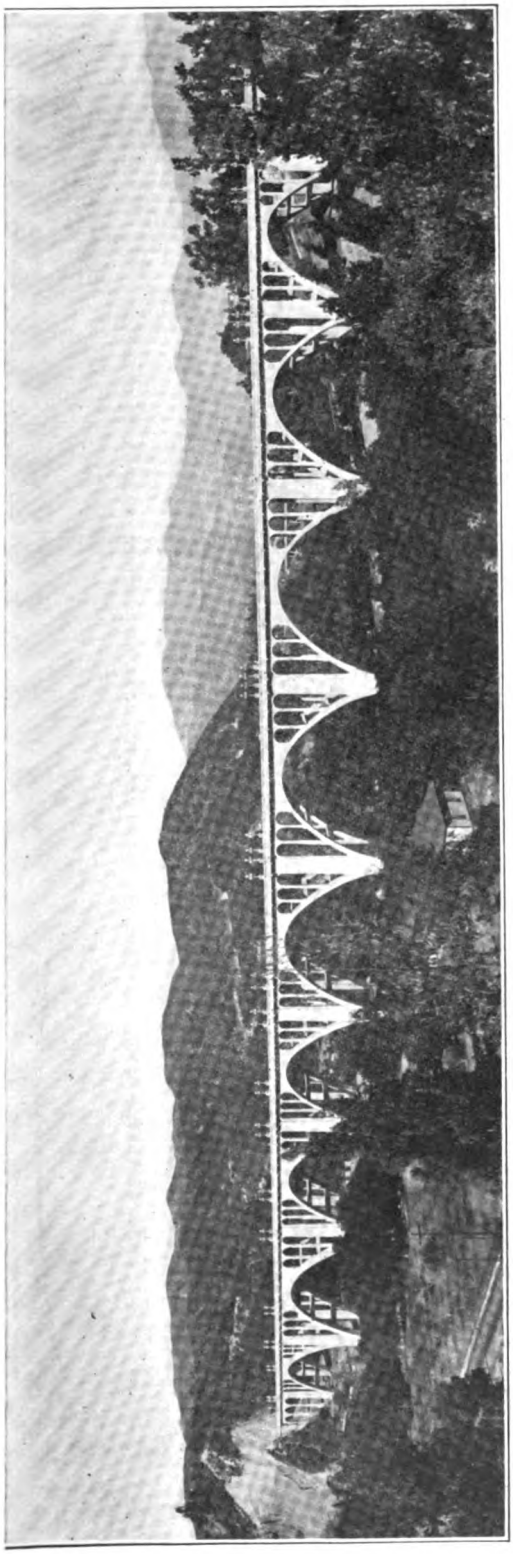
The bridge was formally accepted with appropriate ceremonies in December, 1913, and thrown open to traffic. It is an artistic and interesting structure in itself and as one enjoys a beautiful panoramic view of the surrounding country from its high roadway it will



PLAN AND ELEVATION, PIER No. 4.

*Chief Engineer Mercereau Bridge & Construction Co., Los Angeles, California.

Generated on 2024-09-30 00:35 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



VIEW OF COLORADO STREET BRIDGE. (LOANED BY THE RIVERSIDE PORTLAND CEMENT CO.)

ever be a point of interest for all people in southern California.

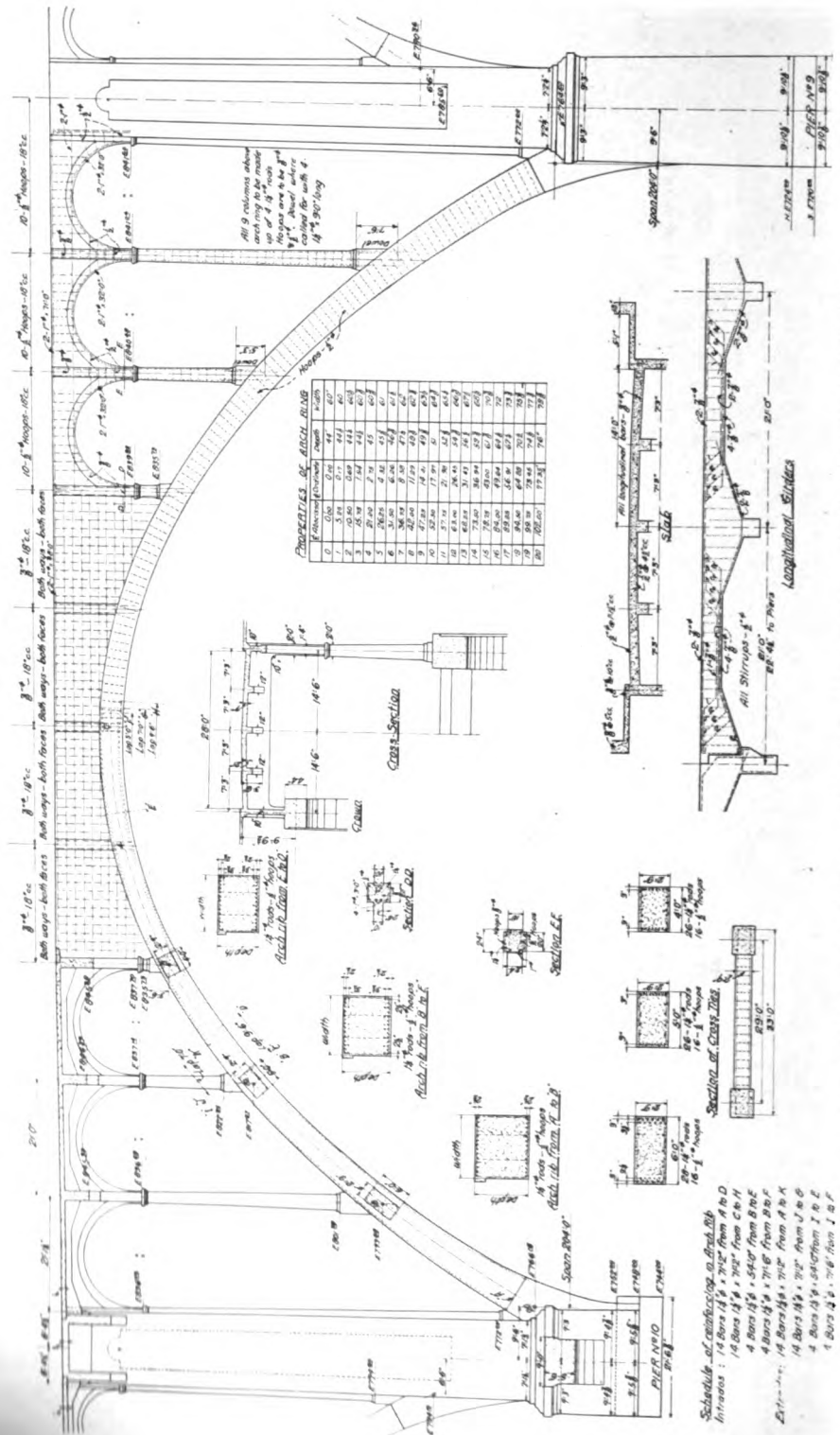
As with other large bridge projects the benefits to be derived by the construction of this bridge were discussed for several years and a number of preliminary plans were made before the project took definite shape. In 1911, however, the city of Pasadena, completed negotiations with Los Angeles county whereby the City and County were each to pay 50% of the cost of the structure.

The city of Pasadena then voted bonds to pay for its proportion of the cost. Then naturally followed the question of design of the structure. As the bridge stands in one of the most beautiful natural parkways of America, and is so situated that it would either beautify or mar the landscape, great care was taken that a bridge which would harmonize with the landscape should be designed. After much discussion Waddell and Harrington, consulting engineers of Kansas City, Mo., were chosen to design the bridge subject to the approval of the county surveyor of Los Angeles county.

The bridge forms the connecting link between Pasadena's main street, Colorado street, and one of the main arteries of Los Angeles county's good road system. Both of these highways came to abrupt stops at the top of the bluff at a distance of approximately 1500 ft. apart. The only connection between these highways was a narrow, dangerous road zig zagging down the bluffs and crossing the Arroyo Seco on an old 100-ft. span timber Howe truss, which was in very poor condition.

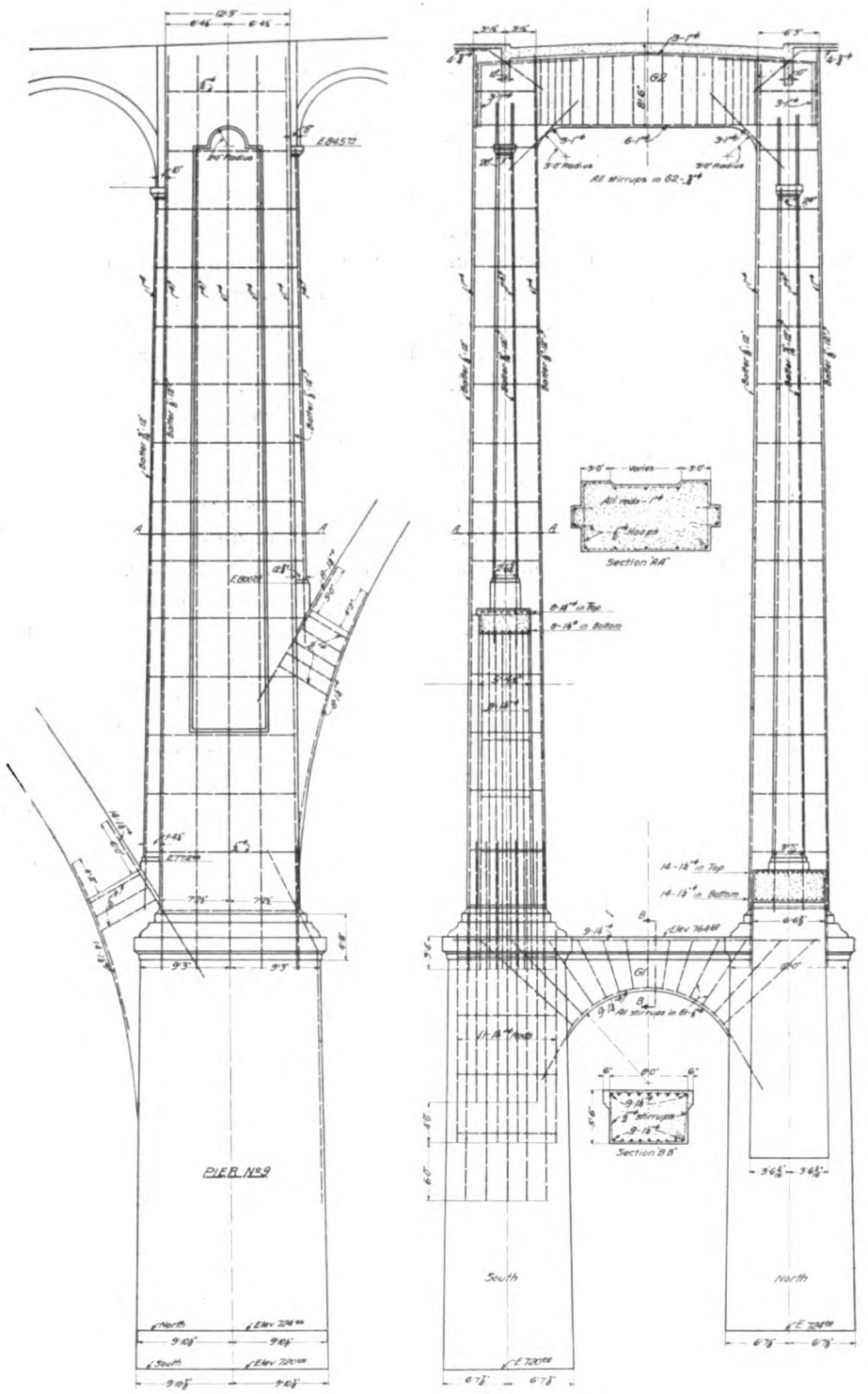
Owing to the peculiar topographic conditions, it was found economical to place the easterly 813 ft. to the bridge on a centre line curve of 916 ft. radius, the central angle of this curve being ap-

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



SIDE ELEVATION OF CENTRE SPAN, SHOWING LONGITUDINAL GIRDERS AND SECTION OF ROADWAY.

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



SIDE AND END ELEVATION OF PIER No. 9.

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

proximately 52°. This portion of the bridge is over an orange grove on a mesa adjacent to the Arroyo. The remaining portion of the bridge is on a tangent crossing the arroyo at right angles.

The portion of the bridge on the curve is constructed in the following manner. The centre of each pier is on a radial line. The piers are so constructed that the difference in length of the two sides is taken up in them, the two ribs of the arches being identical. This gives each pier a trapezoidal shape. The piers are not solid from face to face of bridge, but a separate pier is constructed for each rib; the separate piers being connected below the springing lines by concrete arch diaphragms 8 ft. in width, well reinforced and braced against torsion. The tops of the piers are tied together by braced girders. On the curved portion of the bridge, the entire curve is taken up in the railway and floor system and cantilever brackets, the remaining portions of the piers and arches being constructed on rectangular lines.

The arches for the 105, 140, and 210-ft. spans are of the fixed type with parabolic intrados. In the 105-ft. span, each rib is 2 ft. deep by 3 ft. 8 in. wide at the crown and 3 ft. 6 in. deep by 4 ft. 8½ in. wide at the springing line.

In the 140-ft. span each rib is 2 ft. 6 in. deep by 4 ft. wide at the crown and 4 ft. 6 in. deep by 5 ft. 10 in. wide at the springing line. In the 210-ft. span each rib is 3 ft. 8 in. deep by 5 ft. wide at the crown and is 6 ft. 4 in. deep by 6 ft. 6⅝ in. wide at the springing line.

The arch ribs in each span are tied to each other by six tie beams, placed at regular intervals in the span and at the crown by a cross girder of the floor system. The deck system is of the type known as hollow spandrel construction. Each span is divided into ten panels by cross girders, supported by columns resting on the arch ribs. These cross girders in the 105-ft. are 14 by 45 in. except at expansion joints where they are 14 by 69 inches.

In the 140-ft. span the girders are 16 by 53 in. except at expansion joints where they are 16 by 74 in. In the 210-ft. span, the girders are 20 by 63 in. and 20 by 80 in. respectively. The floor slab on the roadway ranges from 9 to 11 in. thick in the various spans.

The sidewalks are 5 ft. clear width, supported by cantilever brackets of an ornamental design; the concrete slab of which this walk is constructed is 4½ in. thick; the outer edge of the walk is supported by an ornamental fascia girder 18 in. deep upon which rests an artificial stone railing of ornamental design. At each pier artificial stone buttresses are constructed in the railing and upon these buttresses there are ornamental cast iron light posts. Two light posts are placed on each pier at each end. Each of these posts have five large lights, the globes for the centre lights being 18 in. diameter and those for the bracket lights being 12 in. diameter.

The roadway of the bridge is paved with asphalt 3 in. thick. It has a crown of 4 in. in the 28-ft. roadway, the crown, however, is made in the concrete slab itself.

The designers, Waddell and Harrington, deserve real credit in the judgment in selecting a type of bridge which would harmonize in the landscape and their efforts have been marked with entire success. Minor changes in the different members and a change of the grade of the roadway, making it a uniform grade throughout its entire length

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

were made by the engineers of the Mercereau Bridge & Construction Co. under the direction of F. W. Crocker. Waddell and Harrington were represented upon the work by C. K. Allen, their resident engineer, who throughout the progress of the work gave it minute care and attention.

Summary of All Known Concrete Roads and Streets in United States

Compiled by George D. Steele

All figures denote square yards.

The right to reproduce the information contained in this table, and in the accompanying article, is withheld, except where full credit is given both to the author and to The Cement Era.

STATE.	One Course.		Two Course.		Bituminous Top.		Hassam.		Unknown as to Type.		Total Yardage. All Types.		Yardage Laid in 1912-13.	Yardage Laid Prior to 1912.	Total Laid All Years.	STATE.
	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.	1912.	1913.				
Alabama				16,000	12,800	23,800	29,000	7,000			41,800	46,800		28,500	117,100	Alabama.
Arizona						6,800						6,800			6,800	Arizona.
Arkansas	63,000	91,000	15,000			28,000				4,500	78,000	123,500		15,000	216,800	Arkansas.
California	5,000				76,000	1,766,000					81,000	1,766,000	132,000		1,979,000	California.
Colorado	1,000		10,000								11,000				11,000	Colorado.
Connecticut		84,700		1,600	17,300	6,500		31,800		200	17,300	124,300		53,700	195,300	Connecticut.
Delaware	2,300	2,000		12,000	2,100						2,300	14,000		47,700	64,200	Delaware.
Dist. of Columbia									200	6,300	2,100	6,300		900	9,300	Dist. of Columbia.
Florida			30,000	25,000		23,600					30,000	48,600		56,400	135,000	Florida.
Georgia	7,143	18,200				21,200			1,000		8,143	39,400			47,543	Georgia.
Idaho	4,600		41,900	80,000		69,000					46,500	149,000		86,000	281,500	Idaho.
Illinois	63,300	117,270	64,000	8,910	35,700	111,800			13,000	12,380	176,000	250,360		120,140	546,500	Illinois.
Indiana	5,400	19,500	70,200	89,600	56,000	23,300				1,600	131,600	134,000		72,740	338,340	Indiana.
Iowa	285,300	255,660	370,100	312,250		67,200				20,000	655,400	655,110		512,070	1,822,580	Iowa.
Kansas	46,300	31,955	24,300	9,300	44,600	2,200	14,500				129,700	43,455		134,300	307,455	Kansas.
Louisiana			61,000								61,000			107,700	168,700	Louisiana.
Maine					19,400	55,400	18,000				37,400	55,400	26,600	33,500	152,900	Maine.
Maryland	44,000	298,500			18,200	263,100	17,000	30,500			79,200	592,100		33,700	705,000	Maryland.
Massachusetts	20,800	68,650				775	26,600				48,175	68,650		182,500	299,325	Massachusetts.
Michigan	351,915	364,400	159,030	104,200	26,200						537,145	493,200	70,000	724,880	1,825,225	Michigan.
Minnesota	71,600	78,570	5,800	5,800						1,000	77,400	85,370	7,500	32,500	202,770	Minnesota.
Mississippi			1,400			38,500					1,400	38,500		15,000	54,900	Mississippi.
Missouri	296,000	346,240	51,700	29,600		60,400		82,000		103,600	347,700	621,840	29,000	352,400	1,350,940	Missouri.
Montana	3,500										3,503			25,000	28,500	Montana.
Nebraska	2,100		1,100		7,000						10,200	35,000		79,000	124,200	Nebraska.
New Hampshire														9,200	9,200	New Hampshire.
New Jersey	10,300	31,800		1,400	16,500	25,000					26,800	58,200	23,400	12,200	120,600	New Jersey.
New York	945,900	313,785		8,800	325,900	161,900	141,400	90,000		6,300	1,413,200	580,785	311,300	97,500	2,402,785	New York.
North Carolina					27,600	59,000					27,600	59,000	59,000	2,800	148,400	North Carolina.
North Dakota										19,200		19,200		60,500	79,700	North Dakota.
Ohio	67,400	385,200	6,000	6,850	317,600	273,600					391,000	655,650	90,500	62,300	1,209,450	Ohio.
Oklahoma	5,400		8,000								13,400				13,400	Oklahoma.
Oregon	67,400		120,700	185,450						4,000	188,100	189,450	19,000	792,000	1,188,550	Oregon.
Pennsylvania	5,780	37,040	1,950	1,650	13,183	72,340					20,913	111,030		61,830	193,773	Pennsylvania.
South Dakota	5,200	13,000	27,500	7,000							32,700	20,000			52,700	South Dakota.
Tennessee	33,500				13,100	21,000					46,600	21,000		108,760	176,360	Tennessee.
Texas	9,400		22,630	54,140	13,500	3,000	35,400	6,000		17,600	80,930	80,740	13,000	4,000	178,670	Texas.
Utah			2,000	4,000							2,000	4,000			6,000	Utah.
Virginia		7,300			10,000						10,000	7,300		29,100	46,400	Virginia.
Washington		74,680	8,300	203,380	32,850	76,660		34,000			116,650	388,720	126,000	48,800	680,170	Washington.
West Virginia	3,300			1,400		7,700					3,300	9,100		900	13,300	West Virginia.
Wisconsin	63,900	321,180	73,600	95,270	7,300	42,900					144,800	459,350		299,680	903,830	Wisconsin.
Wyoming						21,850						21,850			21,850	Wyoming.
Totals	2,490,738	2,960,930	1,251,710	1,263,600	1,093,608	3,331,750	281,900	281,000	14,200	256,080	5,132,156	8,093,360	907,300	4,303,200	18,436,016	

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

The Engineering Digest

Concrete Road Crossing a Flood Plain*

WIDELY varying problems of design and construction were encountered in building a concrete road, 1 mile long, across the bottom land of the Illinois river in La Salle township, Illinois. A. H. Hunter, division engineer, State Highway Commission, described the features of the improvement at the annual meeting of the Illinois Society of Engineers and Surveyors in a paper from which the following notes have been taken.

For three-quarters of its length the road is subject to the ravages of the stream in flood time; the other fourth is on the bluff approach to La Salle from the south, passing under the Burlington Railroad viaduct, up a 6% grade over the Illinois-Michigan canal and up another grade—5.5%—to a bridge over the Rock Island railroad tracks.

The flood-plain section is laid on an old waterbound macadam surface not more than 22 ft. wide on top, with steep slopes on either side extending to the bottom land 10 or 12 ft. below. The other part, with shale and cinder surface, was restricted in width by the Burlington viaduct, and on the 6% grade was only 18 ft. wide on top. Even then the toe of the side slope extended into the dooryards of adjacent property. Traffic consists of many heavy trucks and a number of pleasure vehicles.

At the instance of the La Salle Commercial Association, the State Highway Commission made survey and plans for a 20-ft. roadway 6 in. thick at the sides and 7 in. at the centre, with a crown of 3¾ inches. Construction was by day labor, except hauling, under the supervision of the highway commission, with Mr. Hunter in charge. The commission also furnished free a 10-ton road roller, a concrete mixer and an operator for each.

Drainage for the foundation was provided by longitudinal ditches 8 in. wide and 6 in. deep under the edges of the metal. At the end of expansion joints a lateral drain, consisting of a trench filled with gravel, leads to the riprap wall at the downstream side of the fill.

The old macadam surface was loosened with a scarifier drawn by the roller; the loose stone was then shaped to the crown of the subgrade and rolled. The surface, which contained an abundance of stone dust, was thoroughly wetted, taking a hard, smooth finish which gave an excellent foundation, as well as furnishing a smooth surface on which to handle the gravel.

The aggregates were screened, washed gravel—granite pebbles—sized from ⅜ to 1¼ in.—and clean, rather fine sand. On the rolled subgrade the loads of gravel and sand were dumped in rows. The quantities per linear foot of road were computed and the wagons measured and loads spaced accordingly. Ten per cent excess of material was provided to allow for waste and variation in thickness. This amount proved sufficient, as there was not an excess or deficiency of more than 10 cu. yd. of sand and gravel in the whole road.

All cement used, comprising some 3200 bbl., was donated by the Marquette Cement Manufacturing Company and the Chicago Portland Cement Company. The uniformity of the mix—1:2:3½—was tested frequently with a wooden measure holding one bag of cement.

Provision for the large amount of water needed for this type of road, both for mixing and curing, was made by laying a 1¼-in. pipe from the city system, with T's every 300 feet.

A self-traction batch mixer was used,

*Abstract from *Engineering Record* April 18, 1914.

Generated on 2024-09-30 00:36 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

with a low hopper in front into which sand and gravel were shoveled direct from the road bed. Two sacks of cement were used for the batch. The mixed material was deposited on the subgrade by means of a 20-ft. rotating boom on which operated a movable bucket. The number of square yards laid per day of eight hours averaged 450.

The soft concrete was struck off to crown and grade with a steel-shod template. Expansion and contraction were taken care of by means of ⅜-in. asphalt joints placed 50 ft. apart at an angle of 60° with the centre line of the road. The joints were protected by Baker plates.

The edges of the concrete were retained by wood forms consisting of 2 by 6-in. pine pieces, 16 ft. long, resting on edge, held to alignment by ⅝-in. iron pins 18 in. long. It was found difficult to butt the boards together perfectly so the more imperfect form pieces were cut in 2-ft. lengths and spliced to the outside of the form with small nails. This practice gave good results, especially on curves, where it was possible to align arcs of circles almost perfectly.

Care in curing the surface was taken in sprinkling and covering with canvas while setting, as is common, and in covering the finished surface with a layer of straw. No earth was available for this purpose, as the lower edge of the fill was swampy. The sprinkling continued ten days, and the straw proved very efficient in retaining moisture.

Detailed costs were figured from the daily expenditures, cost of hauling and the market valuation of the donated materials, including freight and incidentals. The salaries of the engineer and the operators of the roller and mixer were also added. The total cost on this basis, for 10,663 sq. yd., was $13,632.16. Unit costs are given in the accompanying table.

The common labor used was foreign and received 35c. per hour, and teams received 62½c. per hour.

The original plan included a 3-ft. concrete walk on the east side, but it was found that part of the walk would come upon a new fill, and the work has been postponed until the fill has become securely compacted.

The lighting system was adopted at the instance of a local utility company which offered to construct its poles with a special arm from which a light fixture could be suspended. Conduits were placed under the concrete every 120 ft. to provide connections for additional lights which will be added on completion of the sidewalk.

It had been planned to construct the guard fence of reinforced-concrete posts and two lines of 2-in. pipe rail. Later a series of experiments on the design of concrete fences was conducted by the Marquette Cement Manufacturing Company and one of the designs accepted. The successful design consists of a 6-in. square concrete post extending above the ground about 3½ ft., reinforced by a ⅜-in. rod placed near each corner. Slots secure two concrete panels—2 by 6½ in.—reinforced by two small rods near the edges. A 1 by 1 by ⅛-in. angle is embedded in the centre of each rail, to prevent lateral bending.

The posts were placed 7 ft., centre to centre, and the concrete rails were slipped into the slots. This method of erection was quite simple, as no grout of any kind was necessary.

COSTS PER SQUARE YARD FOR LA SALLE CONCRETE ROAD.

Superintendence	$0.023
Excavation, shaping road bed and trimming side roads	0.158
Hauling sand and stone	0.169
Mixing and placing concrete, setting forms and filling joints	0.133
Watchman and miscellaneous labor	0.116
Sand and stone, f.o.b. siding, including demurrage	0.314
Cement, f.o.b. siding, including demurrage	0.310
Expansion joints, f.o.b. siding, including demurrage	0.028
Coal and oil for mixer and miscellaneous supplies	0.021
Forms and other lumber	0.008
Total	$1.280

Generated on 2024-09-30 00:36 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Reinforcing Decayed Poles*

By A. J. PURINTON

A CONCRETE-MIXING car has for some time been used by the East St. Louis & Suburban Railway for mixing and placing concrete at the butts of decayed wooden poles, and has materially reduced the cost of such work. Wooden poles are most susceptible to decay at the ground line, and although a pole might be in good condition otherwise it will finally break at that point. The Orr system of applying concrete to strengthen the pole at its weakest point has been in use by the railway company for some time. Previous to building the concrete-mixing car, material for the reinforcing was loaded on a work car and transported to the site, where the concrete was mixed and placed by hand. It was found, however, that for reinforcing either a small or large number of poles the cost of doing the work in this manner was so high as to make it almost prohibitive. In order to lower the cost it was decided to place a small mixer on a work car. This equipment comprised a 40-ft. double-truck flat car with removable sides, at one end of which an 8-ft. square cab for housing the control apparatus was provided.

The mixer, a No. 0 special Marsh-Capron, is mounted on the rear end and set as high on the car as overhead clearance conditions will permit, thus giving a vertical drop of about 8 ft. from the spout of the mixer to the rails. This mixer is driven by a General Electric motor through reduction gears, and both motor and gears are inclosed in a weatherproof housing. To eliminate the variable speed of the motor it is converted from a series to a shunt-wound, and the speed of the mixer is 20-21 r.p.m., making its capacity 6 cu. ft. per minute. The motor operating the mixer is controlled by the motorman from the cab.

A 200-gal. cylindrical tank is mounted directly behind the cab. Air from the brake reservoir, admitted to the tank through a reducing valve, maintains a constant pressure of 10 lb. From this tank the water is forced through piping to a small measuring tank on top of the mixer. This measuring tank is automatic in its action and can be adjusted to measure out any given quantity of water. In addition all the material necessary for a day's work can be carried on the car. The skip of the mixer, when lowered, lies flat on the deck so that material may readily be shoveled into it.

The mixer discharges into a chute 18 ft. long and 10 in. square, open along the top to permit the use of scrapers should the concrete fail to flow. The chute is pivoted at the mixer and supported at the discharge end by a guy, thus allowing it to be raised or lowered, or swung to either side of the track, as conditions may require. With a few exceptions this chute is long enough to reach all poles on the system on either side of the track, and has sufficient fall to allow the concrete to flow by gravity.

Since this car has been in operation it has been found that the cost of concreting a pole has been reduced by half or more, while from two to three times as many poles may be reinforced in a day as was formerly accomplished by the hand method.

International Engineering Congress, 1915

Among the general subjects to be treated before the International Engineering Congress, 1915, probably the one having the broadest interest is that of Materials of Engineering Construction, which enters into all phases of engineering activity.

The list of topics which will be treated in this section is as follows:

(1) Timber.

(2) Preservative Treatment of Timber.

(3) Substitutes for Timber in Engineering Construction.

(4) Brick in Engineering Structures.

(5) Clay Products in Engineering Structures.

(6) Probable and Presumptive Life of Concrete Structures made from Modern Cements.

*Abstract from *Engineering Record* April 25, 1914.

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

(7) Aggregates for Concrete.
(8) Slag Cement.
(9) Waterproof Concrete.
(10) Cements Containing Additions of Finely Ground Foreign Material.
(11) Economics of the World's Supply of Iron.
(12) The Life of Iron and Steel Structures.
(13) The Employment of Special Steel in Engineering Construction.
(14) The Place of Copper in the Present Engineering Field, and the Economics of the World's Supply Thereof.
(15) Alloys and Their Use in Engineering Construction.
(16) Aluminum in Engineering Construction.
(17) The Influence of the Testing of Materials upon Advances in the Designing of Engineering Structures and Machines.
(18) Cement Testing.
(19) Testing of Metals.
(20) Testing Full-Sized Members.
(21) Proof Testing of Structures.

The papers to be presented from the United States have already been arranged for from the recognized leading authorities on the various topics. Arrangements for the papers from foreign authors are being rapidly concluded, and the aggregation of papers which will be presented will constitute a broad review of the field and be of the highest value.

Marked interest in the Congress from foreign countries continues, and there is every evidence that the attendance from abroad will be large. It is hoped that all engineers in this country who have not yet subscribed as members of the Congress will give the matter their immediate attention and favorable action.

Full information concerning the Congress, the price of subscription, and the arrangement for purchase of volumes of the proceedings, may be obtained by addressing the Committee of Management, as follows:

INTERNATIONAL ENGINEERING CONGRESS, 1915,
Foxcroft Building,
San Francisco, Cal.,
U. S. A.

Road Conditions in 100 Counties

DETAILED studies of local road building systems in 100 counties are now being carried on by the Department of Agriculture in coöperation with the State Highway departments and local road authorities. The purpose of this study is to discover the points of excellence and defects in existing local methods of building and maintaining roads which will aid the State authorities to put local road management on a systematized basis. The coöperating State authorities have been asked to designate counties that present typical and exceptional features as to topography, character of road materials, methods of construction and maintenance, administrative organization, methods of road financing, and traffic conditions. From these lists 100 counties will be selected, and in these counties the Division of Road Economics will make intensive studies.

This investigation is prompted by the fact that there is at present very little knowledge as to the most effective and economical methods by which a county can develop its roads. At present the methods of financing local road improvements vary from calling on farmers for a certain number of days labor in lieu of a road tax, or the use of county prisoners in road construction, to bond issues or maintenance of roads from dram-shop license funds. The Department will study all of these systems with the view to determining what system or combination of systems works best in actual practice.

There is, moreover, at present no standard system of keeping accounts for road building and maintenance, and as a result, while some counties know to a penny the purpose for which money was spent, others have no definite check or reporting system. Among various counties with the same conditions, cost for excavation or other labor is anything but uniform, and many counties, because of the absence of definite knowledge, fail to use local and cheap materials and construct roads which are unnecessarily expensive for their purpose, or which will wear out before the bond issues are redeemed. The investigation will include a careful

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

study of the use of convict labor in road construction.

In connection with the scientific study, the Department's highway engineers will advise freely with local officials as to improvements, and thus give each county visited the advantage of direct coöperation, engineering supervision and assistance.

These investigations, it is believed, will yield important economic data bearing especially on the benefits and burdens of road improvement and showing the extent to which financial outlay under given typical conditions is justifiable.

The heads of State highway departments are manifesting great interest and are coöperating cordially in this work. These data when obtained will be published and thus made accessible to all county and state road officials.

A Two-Form Report of Progress*

By LINDON BATES, Jr.

COST records, so thoroughly systematized in manufacturing plants and mercantile establishments, have been slighted by contracting organizations. Many of the most skilful and successful contractors submit their bids and finish construction work without the accurate knowledge of conditions and costs requisite for the manager whose work is in progress in half a dozen localities. Daily the question arises, "Are we making the estimated profit on the big piling contracts?" and so forth. Without systematic records the executive can have no real measure of efficiency. He can guess; he cannot know. To furnish accurate information, the better managed organizations have developed two report forms: the first, the daily follow-up—a history of progress on each job; the second, a monthly cost record. The daily report keeps the executive in touch with work going on; the monthly report gives a record of costs to serve as a basis for calculations and to sum up results for the period.

The first aim of the daily report is to give a record of operations and results. The more vividly it portrays conditions, the better it serves. To accomplish this, the number of men on each job is recorded, not, for example, as "123 labor hours on second-class concrete, Division A3," but as "12 laborers building concrete abutment for Roberts bridge." The latter statement is far more easily grasped when the reader is miles away from the work. Indeed, the most complete reporting systems, giving daily costs to the third decimal of a cent, have proved unsatisfactory because they have not conveyed a real picture. For, while the 'labor hour' is mathematically accurate, the human mind fails to translate it into a picture of working conditions.

Brevity in the report also adds to its value. If a daily report covers several pages it usually includes unessential details, and under pressure of routine business the busy manager cannot devote any great time to poring over pages of statistics. He must grasp the situation at a glance, and needs only simple records of results.

To meet these fundamental requirements the daily report of 'Labor, Plant, and Work Done' has been evolved, one sheet for each day, thirty-one bound together as a monthly book. The original white sheet signed by the compiler and the local superintendent, goes to the central office by the first mail, the yellow carbon copy being retained at the job. The reports of each month, bound in a separate cover, are filed in the central office. A simple report (Form I) represents the composite idea of half a dozen superintendents in close practical touch with construction problems and of as many executive officers, who have spent weeks of work inspecting hundreds of proposed reports and carefully planning every space in the form chosen.

But the proof of a record is that it can be read. Imagine the president of a great construction company back from a month's inspection trip—say of a proposed harbor work in Mexico. He must be able to put his finger on the very pulse of the business.

*Abstract from *System*, March 1914.

Generated on 2024-09-30 00:36 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

When he returns to his desk, the reports of the previous day from Contract No. 6 are given him. He reads: "Dredge *Peconic*, 3 shifts, 1500 yd.; *Pontiac*, 1820 cu. yd., 3 shifts"—both a fair average output. "Total excavation in the month carried forward 26,400 cu. yd." And so on. In ten minutes he is in touch with everything that is going on.

Monthly reports complete the check. Estimates of work done and payments therefor are made by the month in all state contracts, and almost invariably on railroad and other corporation work. Unless the law provides to the contrary, labor is likewise paid monthly, and payments for supplies, fuel, and other items are similarly made.

CONTRACT NO. 6 — Watertown, Ohio — DAILY REPORT — DATE July 17 1912 — WEATHER Fair

Account No.	Class of Work	Location Sta. No. Sta. No.	Shifts	Class of Labor: Walking Bosses	Foremen	Operators	Engineers	Firemen	Ships Crew	Watchmen	Teams	Artisans	Laborers	Cranesmen	Office: Superintendent	Civil Engineers	Clerks	Cost of Labor and Office	Plant in Operation: Dredges	Tugs	Scows	Pile Drivers	Concrete Mixers	Work Done: Excavation C.Y.	Piles Driven	C.Y. Concrete	Holes Driven	Remarks
3-a	Dredge Pontiac	354	3		3	1	3	6					1	3				42 10	1		3			1820				
3-b	Repairs Pontiac				1							2	1					9 70										Repair Gang
4-a	Dredge Peconic	327	3			1	1	3	6				2	3				43 80	1		2			1590				
4-b	Repairs Peconic																	5 20										Crew Repairing
5-a	Rock Cutter Freya	462	3		1		3	3	9				1					42 30									98	
5-c	Removals		1		1								3					6 20										Cutter pound
66	Operating Dept		3			6	3		15			1						72 15		3								
76	Altering Scows		3		1						2	1	7					35 16										Change to bottom dump
24-b	Storeroom				1						1	3	2					23 95										
21-b	Engineering											2				1		7 20										
20-b	Admin + Office														1	2		8 30										
8-b	Spoil Area #1									1								2 00										Taking up Track
14	Concrete Abutment Potash Bridge				1								10					24 00										
	Totals for Day				6	12	8	4	36	1	3	9	27	6	1	1	2	322 06	2	3	5			7410			98	
	Brought Forward																	5581 10						23050		3001		
	Month to Date																	6003 16						26460		3099		

Compiled by Howard P. Crockett — Approved by H. N. James, Supt.

FORM 1.

The monthly report (Form II) must show the 'quantities' achieved 'during the month' and 'to date' on the contract specifications, as well as 'costs.' This information comes from the payroll and the ledger, proper payroll distribution giving the wages of each gang and the labor costs of each 'work-unit.' All material is charged against a regular account number for distribution. Since these ledger entries charge to the same work-units and give true material costs, while the payrolls give the labor costs, the two elements are accurately set forth for future use.

The first item on the monthly record is 'clearing,' the engineer entering opposite this head the percentage for the month and to date. Two columns are given, one for material and one for labor cost. 'Grubbing' is the second item. The payroll gives the number of men and the wages paid, the ledger charging their axes, mattocks, and shovels to account 'clearing and grubbing.' The record is complete without further subdivision; and 'unit costs' and 'per cent of total' are available for both the executive report used in planning future work and the cost records.

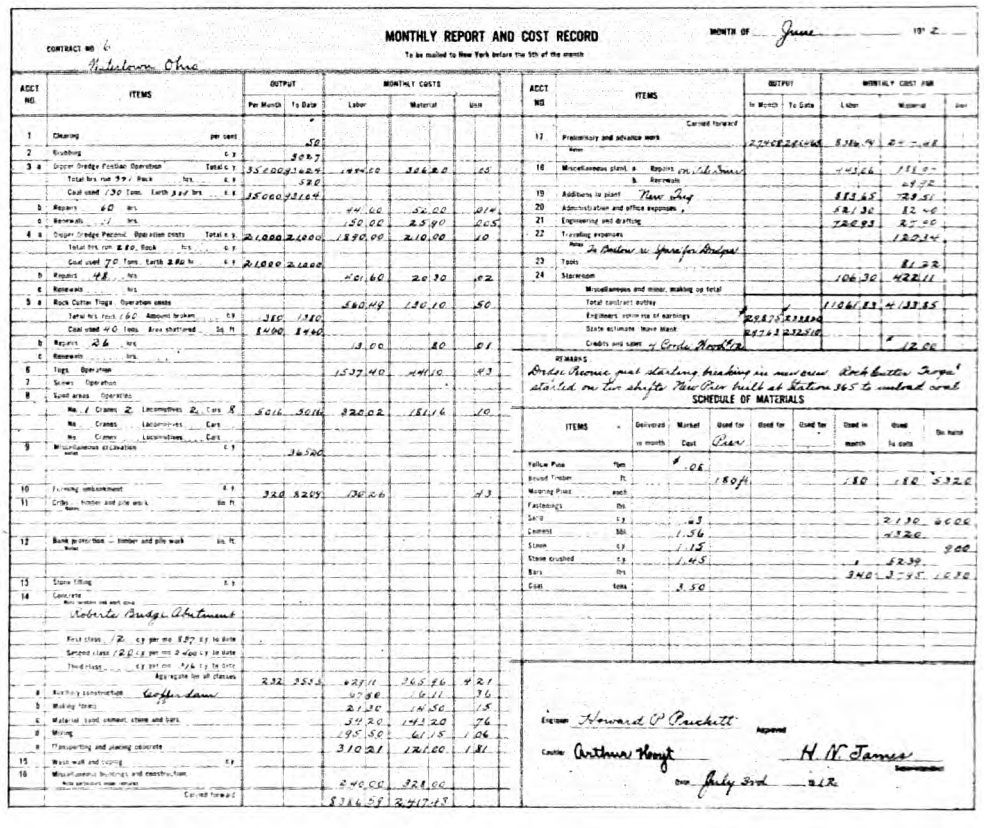
The third item is 'all excavation,' paid for by the cubic yard. Here careful differentiation must be made; for by pick and shovel a certain material may cost $1 per yard, by dipper dredge 16 to 25c., by scraper 27 to 35c. To have these dissimilar elements grouped under one head, 'excavation', would give no reliable data. Even a cost record under the head of 'dipper dredging' would mislead; for while one dredge is working against a clay bank at one unit cost, another may be working in the river bed at

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

nearly three times the expense. For true costs, the elements must be resolved into the lowest terms. The 'dredge *Pontiac* dredging rock,' 'rock-cutter *Tioga*,' 'rock excavation by hand,' 'earth excavation by hand' are therefore, by analysis, the headings which give true costs when labor and materials items are correctly charged.

Here the contract superintendent intervenes: "How does the cashier at the office know where the boats are digging? He can't tell if the coal and oil we send down to the *Pontiac* from day to day is charged to 'digging rock' or 'digging dirt.' Can't we charge it to each machine?" And he is right. The report states the nature of material, but the charges are made to the various machines, scows, and so forth. So, for final analysis of the single item 'excavation,' the contractor is obliged to carry six main heads, subdivided to give all the cost elements separately: the dredge *Pontiac*, dredge *Peconic*, rock-cutter *Tioga*, tugs, scows, and miscellaneous excavation.

Three items follow: '1st class concrete, 2nd class concrete, 3rd class concrete.' These three grades vary only in the relative percentages of cement, crushed stone, and sand which they contain. One batch of third class may be put through the mixer at 10:30 a.m., and run down to the abutment by wheelbarrow; three batches of second class may be hurried down at 11 a.m.,



MONTHLY REPORT AND COST RECORD

To be mailed to New York before the 5th of the month

CONTRACT NO. 6 — Middletown, Ohio — MONTH OF June 19 2

ACCT NO.	ITEMS	OUTPUT Per Month	OUTPUT To Date	MONTHLY COSTS Labor	Material	Unit
1	Clearing per cent		50			
2	Grubbing c.y.		3067			
3 a	Dipper Dredge Pontiac Operation Total c.y.	35000	31424	1494.60	346.20	.05
	Total hrs. run 59 / Rock hrs. c.y.		320			
	Coal used 130 Tons. Earth 332 hrs c.y.	15000	31164			
b	Repairs 60 hrs.			44.60	52.00	.014
c	Renewals .1 hrs.			150.00	25.90	.005
4 a	Dipper Dredge Peconic Operation costs Total c.y.	21000	21000	1890.00	210.00	.10
	Total hrs. run 210 Rock hrs. c.y.					
	Coal used 70 Tons. Earth 286 hr c.y.	21000	21000			
b	Repairs 48 hrs.			501.60	20.30	.02
c	Renewals hrs.					
5 a	Rock Cutter Tioga Operation costs			560.49	130.10	.50
	Total hrs. rock 160 Amount broken c.y.	385	1380			
	Coal used 40 Tons. Area shattered Sq. ft.	8400	8400			
b	Repairs 26 hrs.			13.00	80	.01
c	Renewals hrs.					
6	Tugs. Operation			1537.40	441.10	.93
7	Scows. Operation					
8	Spud anchors. Operation					
	No. 1 Cranes 2 Locomotives 2 Cars 8	5016	5016	320.02	181.16	.10
	No. Cranes Locomotives Cars					
	No. Crawy Locomotives Cars					
9	Miscellaneous excavation c.y.		3450			
10	Forming embankment c.y.					
11	Cribs timber and pile work fbm. ft.	320	8205	136.26		.03
12	Bank protection — timber and pile work fbm. ft.					
13	Stone filling c.y.					
14	Concrete — Roberts Bridge Abutment					
	First class 12 c.y. per mo. 337 c.y. to date					
	Second class 120 c.y. per mo. 240 c.y. to date					
	Third class c.y. per mo. 336 c.y. to date					
	Aggregate for all classes	232	3553	627.11	265.46	4.21
a	Auxiliary construction — Coffer dam			9.98	6.11	.76
b	Making forms			21.30	14.50	.15
c	Material (sand, cement, stone, and bars			34.20	143.20	.76
d	Mixing			195.50	61.15	.106
e	Transporting and placing concrete			310.21	126.00	1.81
15	Wash wall and coping c.y.					
16	Miscellaneous buildings and erections from — New versions now varying			240.00	328.00	
	Carried forward			3286.59	3417.48	

ACCT NO.	ITEMS	OUTPUT To Month	OUTPUT To Date	MONTHLY COST PER Labor	Material	Unit
	Carried forward	27402	24465	5386.49	2[illegible].48	
17	Preliminary and advance work — None					
18	Miscellaneous plant a Repairs on old Tower			443.66	151.07	
	b Renewals				49.52	
19	Additions to plant New Derrick			833.65	729.51	
20	Administration and office expenses			681.30	82.46	
21	Engineering and drafting			726.93	27.90	
22	Traveling expenses — Note In Bottom of Spare for Bridge				1202.14	
23	Tools				81.32	
24	Storeroom			106.30	422.11	
	Miscellaneous and minor, making up total					
	Total contract outlay			11066.83	4133.85	
	Engineers' estimate of earnings	29878	232820			
	State estimate Name blank	29763	232510			
	Credits and sales of Circle Hook Etc				12.00	

REMARKS

Dredge Peconic put starboard breaking in main crew Rock Cutter Tioga started on two shifts New Pier built at Station 365 to unload coal

SCHEDULE OF MATERIALS

ITEMS	Delivered in month	Market Cost	Used for Piers	Used for	Used for	Used in month	Used to date	On hand
Yellow Pine fbm		.08						
Round Timber ft		150 ft				180	180	5320
Mooring Piles each								
Fastenings lbs								
Sand c.y.		.43					2130	6000
Cement bbl		1.56					4320	
Stone c.y.		1.15						900
Stone crushed c.y.		1.45					5239	
Bars lbs						340	3795	1620
Coal tons		3.50						

Engineer Howard P Puckett — Approved H N James

Contr Arthur Hoyt — Superintendent

Date July 3rd 1912

FORM 2.

and at 11:45 two batches of first. In such a situation it is practically impossible for any ledger clerk, or timekeeper, to figure accurate costs. In building a dam across the Hudson, one company did try to charge labor and material. The following shows the result:

	Ledger record of expenditures.	State estimate of quantities in place.
1st class concrete..	$ 54.27	$ 5,483.90
2nd class concrete.	38,664.69	14,725.12
3rd class concrete.		1,815.50

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Receiving $5000 for work 'costing' $54.27 was only capped by the tragedy of receiving $14,000 for work 'costing' $38,664.69. And it was the fault, not of the clerk who was given an impossible job, but of unaccountable cost heads. Total payments *versus* total expenditures, showing the record of profits and the market price of cement, however, give a reasonably reliable index of the profit coming from each grade of concrete. Wash wall and coping, stone filling, and rip-rap are items appearing in nearly all contractors' schedules.

Finally, the timber used to make up pile decks, and pile bank protection must be recorded. Here the official headings, 'yellow pine timber,' 'round timber,' and 'mooring piles,' 'iron and steel fastenings,' need be combined rather than subdivided. Since the same laborers fit the timbers, drive in the iron fastenings, and install the planking, their joint work must be charged to one heading, 'crib work.' The profit on the different timber items, like that on the three grades of concrete, must be reckoned from the total costs of the crib work and the market cost of materials. The monthly report must, therefore, include a schedule of timbers, logs, fastenings, cement, and sand, showing the amount used for each job, the market cost, and the stock on hand.

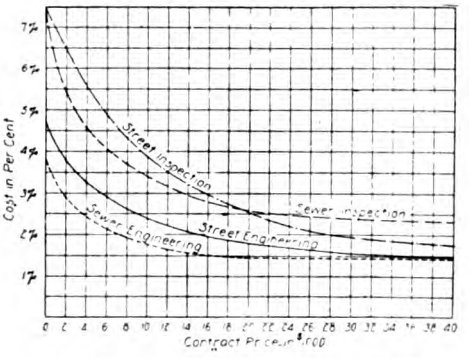
The contractor desiring further data must then add items to cover the general expenses. 'Preliminary and advance work' executed to prepare the way for actual operations; expenditures for building levees or for leveling the beam along which a pile-driver travels, and so forth; 'administration and office expenses,' 'engineering,' 'additions to plant,' 'traveling expenses'—such captions as these must also be on record from month to month. Finally, the total contract cost for the month is inserted. The engineer's estimate of the month's earnings is put below this head, and a blank remains for the estimate of the engineer employed by the state, city, or corporation, and so forth. The contract cashier, responsible for the cost record, and the engineer, responsible for quantities, both sign the report. The contract superintendent, responsible as commanding general, finally gives his approval.

With these two reports, the daily picture and the monthly cost sheet, the manager in active charge has a complete grasp of his work and can follow it from day to day; the president or chief executive is in touch with technical and financial details, and the treasurer can trace every cent expended from day to day. The main danger of scattered contracts—padded payrolls—vanishes when each man is accounted for on daily records, whose monthly totals afford a check on the payroll.

Engineer's Note Book

Street and Sewer Construction at Spokane, Wash.

THE accompanying diagram gives the cost of engineering and inspection on sewer construction and street improvement work in Spokane, Washington, during the year 1912. It will be noted that four curves are given on the diagram showing, respectively, the



COST OF ENGINEERING AND INSPECTION.

cost of street engineering, street inspection, sewer engineering, and sewer inspection. The cost of the engineering and inspection is stated as a percentage of the contract price.—*Engineering & Contracting*, July 9, 1913.

Diagram of Cost of Retaining Walls*

By E. F. KRIEGSMAN †

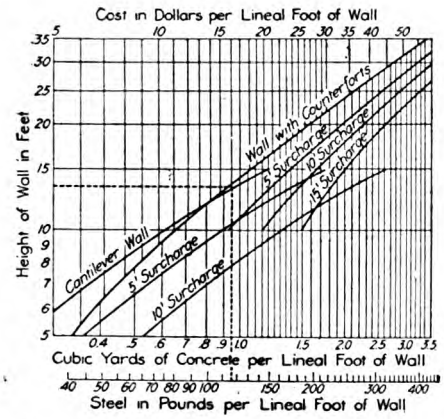
THE diagram shown in this column is one that the writer has had made in order to ascertain quickly the approximate cost of retaining walls. It is useful in determin-

*Abstract from *Engineering Record*, August 9, 1913.

†Assistant Engineer, City Engineer's Office, San Francisco.

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

ing approximate cost of walls in connection with re-grade work, viaduct and tunnel approaches, etc. Usually one has to wait for the designer to ascertain the quantities before a preliminary cost report can be made. This manifestly has its disadvantages.


Cost in Dollars per Lineal Foot of Wall
Height of Wall in Feet
Cantilever Wall
5' Surcharge
10' Surcharge
Wall with Counterforts
5' Surcharge
10' Surcharge
15' Surcharge
Cubic Yards of Concrete per Lineal Foot of Wall
Steel in Pounds per Lineal Foot of Wall

APPROXIMATE COST OF RETAINING WALLS.

In constructing the diagram, about 40 wall designs were investigated and the quantities computed. The results were next plotted on logarithmic cross-section paper and average curves drawn representing the amounts of concrete and steel reinforcement for various heights of wall having a 1-ft. length. An average price of $17 per cubic yard for concrete, steel, forms, and finish was applied to these yardages. All that one needs is the grades of the top and bottom of the proposed wall, when one can readily approximate the cost of the finished wall with the use of the diagram.

The price of $17 per cubic yard may not meet the requirements of many engineers, as local conditions vary considerably. If another unit price is desired, all that is necessary is to trace the cost scale on tracing cloth and move it horizontally until the desired cost is in the same vertical with the 1-cu. yd. line in the diagram now occupied by $17 at the top. The new location of the cost scale will give the desired cost for the given local conditions.

For illustration, the dotted line shows that a cantilever wall 14 ft. high, without surcharge load, would contain 0.95 cu. yd. of concrete and 116 lb. of steel reinforcement, and would cost approximately $16 per linear foot. Excavation must be figured separately in every case.

Book Reviews

DESIGNING AND DETAILING OF SIMPLE STEEL STRUCTURES. By Clyde T. Morris. McGraw-Hill Book Co., New York. P. 249. Index. For sale by the *Mining and Scientific Press*, San Francisco. Price $2.25.

This is the third edition of Mr. Morris' well known work, the first having been published in 1909. The entire book has been revised and several of the chapters have been partly rewritten. A new chapter on highway bridges has been added, together with a reprint of the specifications for steel highway bridges of the State Department of Ohio. The text has been prepared primarily with a view to the presentation of data applicable to simple structures and which can be taken up in the technical schools during the comparatively limited time usually allotted to the subject. General cases and specific examples are given of the application of the laws of statics to steel structures in order that details may be produced which are in accordance with the stresses to which they are subjected.

THE CONTROL OF WATER. By Philip A. Morley Parker. D. Van Nostrand Co., New York. P. 1037. Index. For sale by the *Mining and Scientific Press*, San Francisco. Price $5.

This is an exceptionally comprehensive work and deals with water as applied to irrigation, power, and domestic supply. It is a manual for engineers rather than a text-book, and embraces essentially the author's actual engineering experience accumulated during a period of some 18 years of professional activity. Comparatively little space is devoted to the discussion of theory, but the volume is replete with data taken from actual experience, and shows many instances of the inaccuracy of many of the standard formulas in constant use as compared to the results achieved in practice. The data are prepared in 16 subdivisions, of which the following is a summary:

Preliminary Data; General Theory of Hydraulics; Gauging of Streams and Rivers; Gauging by Weirs; Discharge of Orifices; Collection of Water and Flood Discharge; Dams and Reservoirs; Pipes; Open Channels; Filtration and Purification of

Generated on 2024-09-30 00:31 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Water; Problems Connected with Town Water Supply; Irrigation; Movable Dams; Hydraulic Machinery other than Turbines; Turbines and Centrifugal Pumps; Concrete, Ironwork, and Allied Hydraulic Construction.

HANDBOOK OF ELECTRICAL METHODS. McGraw-Hill Book Co., New York. P. 277. Index. For sale by the *Mining and Scientific Press*, San Francisco. Price $3.

In reviewing Halsey's mechanical engineer's handbook in a recent issue, we took occasion to comment upon the great quantity of valuable data published from time to time in the technical press and which through the lack of efficient methods of filing and indexing are often lost forever as far as future reference is concerned. Publishers of technical books and also of technical journals have recently come to a realization of the opportunity afforded in classifying and recompiling such data in book form for the benefit of practising engineers. The *Mining and Scientific Press* has done an excellent work in this respect in the publication of a series dealing with the advancement of the cyanide process and other subjects. The 'Handbook of Electrical Methods' is compiled in the same manner, the data contained therein being taken largely from the *Electrical World*. Such matter contained in the original articles as would be of no more than transient interest has been eliminated, leaving the bare facts and conclusions drawn by many engineers during the course of their own practice. This compilation relates to ways of doing things rather than to design, descriptions of apparatus, or to any of the commercial phases of the electrical industry. It is, therefore, a work of an importance to the practising engineer that can hardly be exaggerated. No attempt has been made by the editors to indulge in comment on any of the subject-matter, the object being to present to the reader the accumulated results gleaned from the experience of hundreds of men in the daily practice of their professions. An idea of the scope of the work may be obtained from the following summary of the contents: General Notes; Line Construction and Equipment; Meters; Operation of and Changes in Circuits; Switchboards and Power House Details; Signs, Display Lighting, Special Lighting Applications; Lamps and Lighting Circuits, Signal Bell Connections, etc.; Transformers, Oil Switches, and Circuit-Breakers; Interior Wiring; Motors, Motor Switches, Generators, etc.

ELEMENTS OF WATER BACTERIOLOGY. By S. C. Prescott and C. A. Winslow. P. 318. John Wiley & Sons, New York, 1913. For sale by the *Mining and Scientific Press*, San Francisco. Price $1.75. Reviewed by Edward Bartow.

The book was originally prepared in 1904 for students of biology and sanitary engineering at the Massachusetts Institute of Technology. To cover advances in the science it was revised in 1908. Because of further advances and because of the publication in 1912 of the revised edition of Standard Methods of Water Analysis by the American Public Health Association, the third edition has been prepared.

The book is a very satisfactory and modern treatise on water bacteriology. This is especially true with respect to sanitary water analysis. The recent recommendations of the committee on Standard Methods are discussed. The authors do not agree with the recommendations of the committee that the 37°-count should replace the 20°-count, but agree with the resolution adopted by the Laboratory Section of the American Public Health Association at the Washington meeting, that both determinations should be made in ordinary routine water examination.

The chapter dealing with the isolation of pathogenic bacteria dwells especially on the recent methods for the isolation of typhoid bacillus. The authors believe that the whole group of lactose-fermenting bacilli is significant and that the lactose bile fermentation test is sufficient identification of the colon group for ordinary sanitary purposes. The specific identification of B. coli is therefore not necessary in routing tests. A new chapter dealing with the sanitary study of shell fish has been added. The book as a whole is a very satisfactory treatise, valuable both to the student and to the practical worker in the field of water bacteriology.

THE OIL FIELDS OF CRAWFORD AND LAWRENCE COUNTIES, ILLINOIS. By Raymond S. Blatchley. Bulletin 22. P. 442. Ill. Urbana, 1913. Everything connected with these important oil-producing areas is described by the author, after three years investigation.

Generated on 2024-09-30 00:35 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Company Reports

The Appleton Land & Water Co., of Los Angeles, operating in San Bernardino county as a land and water corporation, has asked authority of the California Railroad Commission to lease its water plant in the town of Victorville, San Bernardino county, to the Victorville Domestic Water Co. The lessees will pay to the Appleton company an amount equal to the annual net revenue now received by the applicant from its distributing system. The Victorville distributing system is now valued at $15,000. The Appleton company desires to execute the lease so as to maintain its land business as a business free from the obligations of a public utility water company.

James A. Murray and Ed. Fletcher, owning a water system distributing water to the cities of San Diego, East San Diego, La Mesa, El Cajon, and adjacent territory in the county of San Diego, have filed an application with the California Railroad Commission asking authority to sell their property to the Cuyamaca Water Co. The applicants are willing to accept corporate stock in the sum of $600,000 and bonds of the face value of $900,000. The property to be transferred consists of the Cuyamaca reservoir, Murray Hill reservoir, La Mesa reservoir, and Eucalyptus reservoir, and the diverting dam, flumes, aqueducts, pipes, pipelines, and ditches in the county of San Diego.

The Indian Valley Electric Light & Power Co. has filed an application with the California Railroad Commission, asking the Commission to modify an order made September 1912 which authorized the Company to issue $81,535 6% bonds. The Company has issued none of the bonds authorized under the order, and wishes now to enter into an agreement with the Great Western Power Co. to take power at the Big Meadow dam, which is 13 miles from the main station of the applicant. The agreement will require an outlay of $20,295.85 for the construction of a transmission line 13 miles long between Big Meadow dam and Greenville, where the Indian Valley Electric Light & Power Co. has its main station. The Company is to change its name to the Plumas Light & Power Co., under which name it desires to issue $80,000 first-mortgage 6% bonds. The Company had originally planned to develop hydro-electric power of its own.

The California Railroad Commission has dismissed the application of the Modoc County Irrigation Co. for authority to issue bonds, notes, and other evidences of indebtedness in the sum of $750,000. The Company is at present engaged in litigation in Modoc county involving essential water rights at Cowhead and Pelican lakes. The Commission finds that this matter should be decided before the Company undertakes to promote a bond issue. There is an outstanding indebtedness of $85,000 covering construction work already completed on the irrigation system, which is intended to supply 50,000 acres of arable land in the vicinity of Cowhead and Pelican lakes.

The Sawtelle Water Co. reports for 1913 as follows:

Assets:	
Fixed capital	$65,847.73
Cash	151.41
Accounts receivable	16,116.73
Other assets	69.98
Total	$82,185.85
Liabilities:	
Capital stock	$50,000.00
Accounts payable	14,385.94
Surplus	17,799.91
Total	$82,185.85
Profit and loss:	
Operating revenue	$ 9,338.84
Operating expenses	8,704.1.
Net operating revenue	$ 634.73
Non-operating revenue	844.68
	$ 1,479.41
Taxes, interest, etc.	534.45
	$ 944.96
Balance December 31, 1912	16,661.95
	$17,806.91
Additions	11.55
	$17,816.46
Deductions	18.55
Balance	$17,799.91

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Industrial Progress

Engine Driven Continuous Current Generators of the Commutating Pole Type

A new line of engine type, commutating pole, continuous current generators has been recently placed on the market by the General Electric Company. These machines embody all the advanced refinements in the electrical and mechanical design of this class of apparatus, which enable them to meet the most exacting service requirements modern applications demand.

The generators are offered in the usual complete line of standard sizes ranging from 25 kw. to 400 kw. inclusive. They are manufactured in both the two-wire, designated Form LD, and three-wire, known as Form LDS, types, with either shunt or compound field windings and with armatures wound to deliver the rated kw. output at any voltage from 115 to 125 volts or 230 to 250 volts. Larger sizes of both types and wound for 250 volts only are built on specification.

The speeds of these generators are in conformity with modern engine practice, and were selected after a careful consideration of the recommendations and requirements of leading engine builders. Compound wound machines, automatically compensating for line drop in the distribution system, are built for any desired degree of compounding from no-load to full-load, although 4 to 5% is usually sufficient for average conditions and standard field windings provide for this amount. The frame is designed for installing on the engine bedplate or masonry foundations, and the armature is bored for mounting on the engine shaft.

The utilization of commutating poles in these generators is one of the distinctive features of the new design, and permits operation over an extremely wide range of load and voltage with fixed brush position and sparkless commutation. The commutating winding produces a magnetic field flowing in a direction that assists the reversal of current in the coil undergoing commutation, and is also directly opposed to the field generated by armature reaction tending to retard current reversal in this coil.

The commutating field thus completely nullifies the distortive effect of armature reaction on the main field flux in the commutating zone, and generates an emf. that helps the brush to commutate the current in a natural neutral without sparking and with a consequent increased life of the commutator and brushes. Inasmuch as the commutating windings are directly in series with the armature, their strength varies directly with the armature current and provides the correct rectifying effect for proper reversal of current in the coils at all loads. Hence it is unnecessary to shift the brushes as the load changes.

A new and very important feature of this line of generators is the development of the three-wire machines with a special type of revolving compensator. The advantages of the three-wire system for the distribution of electrical energy at low voltages are well understood. The principal advantage is the fact that a 125/250 volt three-wire system requires about one-third the amount of copper in the distribution system required by a 125 volt two-wire system. Thus the adoption of the three-wire system for a combined lighting and power load saves about two-thirds the investment in copper.

The adoption of the revolving compensator with one collector ring for obtaining the neutral connection with three-wire operation is somewhat of a radical departure from previous designs. This design supersedes the familiar separate stationary compensator and two collector ring arrangement. The revolving compensator consists of a circular magnetic core upon which are mounted suitable exciting coils, the core with its coils being assembled on a cast bracket bolted directly to the back end of the armature spider. The compensator fits under the overhanging end windings of the armature, projecting but a short distance beyond the main winding, and requires no additional allowance in floor space.

The compensator windings are connected to the main armature winding at proper points, and the neutral connection is taken through the armature spider to a single collector ring mounted on the outer end of the commutator shell. The neutral brushes bearing on this ring are supported by and insulated from the main brush-holder studs. The simplicity of this design, self-contained with the armature, eliminates floor space taken by the stationary compen-

Generated on 2024-09-30 00:33 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

sator, requires fewer collector rings and brushes, and reduces the number of cable leads to the switchboard.

Revolving compensators may be applied and connected to standard Form LD two-wire armatures. Aside from the armature construction, the only important difference between a two-wire Form LD and a three-wire Form LDS generator is in the field connections. In the three-wire generator the series and commutating fields are equally divided between the two sides (positive and negative) of the armature, insuring exact compounding for all load conditions whether balanced or unbalanced. Three-wire generators are designed to carry an unbalanced current of 25% of the rated full load current in the neutral.

Particular attention has been given to the ventilation of these machines. Armature cores, windings, spiders and flanges, commutator shells and all field coils are of the open construction, allowing a free circulation of air through and around all component parts, which assures low temperatures, good efficiency and durability of the insulation. The magnet frame is cast steel split horizontally above the centre line, so that the generator can be taken apart for cleaning, inspection or repair without removing any of the field poles.

The main poles are of laminated steel, punched to suit the finished frame and held in place by bolts. The main field is constructed with the series coil mounted outside the shunt coil, and is separated a sufficient distance to permit thorough ventilation and insure easy access to either coil. The shunt coil is thoroughly insulated on a sheet metal body and is supported by heavy insulating collars. The commutating poles are of rolled steel held in place by bolts and carry a helical winding of edgewise-wound copper strip, insuring effective radiation of heat. Either main or commutating poles with their coils are readily removed without interfering with the magnet frame or brush rigging.

The armature windings, either multiple or series as best suits the design, are formed from bar stock in coils of endless type, without joints or clips on the back end; and the design of the coil is such that an exceptionally free circulation of air is obtained around and through the end windings. An improved wrapped type of insulation supersedes the trough type used on previous designs. The windings are held in the slots by hardwood wedges dovetailed in the punchings, and on the ends by binding bands, which do not, however, extend over the core.

The end connections are supported by flanges bolted to the armature spider. Suitable equalizer connections are provided on all multiple wound armatures to prevent any difference in voltage due to variation in the air gap, and also to equalize the magnetic pull on the shaft.

The commutator segments are made of liberal depth, from hard drawn copper, insulated from the shell and from one another by mica gauged to uniform thickness and of such hardness as to wear evenly with the copper. On the smaller sizes the back clamping rings are cast integral with the commutator shell, the outer clamp ring being a separate casting. On the larger sizes both clamping rings are separate castings.

The commutator segments are of sufficient length to permit staggering the brushes, which insures even wear of the entire commutator surface. The commutator is supported independently of the shaft, being mounted on an extension of the armature spider. The segments are connected to the armature winding by copper strips soldered into the segments and to the armature conductors.

The armature core is built up of thin laminations thoroughly annealed, assembled and keyed to a finished seat on the armature spider. Through bolts hold the assembled core in place between two cast iron flanges, one of which is cast integral with the spider. These bolts are placed within the inner periphery of the punchings and do not pass through the core. A liberal number of radial air ducts are provided to insure good ventilation.

The brush rigging is of an improved mechanical design, the yoke fitting closely in a groove turned in the magnet frame. The brush-holder brackets are firmly attached to the yoke and are made adjustable to allow for natural wear of the commutator. The brush-holder studs are riveted in the brackets and are supplied with a liberal number of brush-holders. No shifting device is furnished or required. After the brushes are once adjusted in their proper position, the yoke is locked in place and no further brush shift is necessary.

The design of the brush-holder embodies

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

distinctive features. The brush-holder body is a single piece brass casting bored for the stud fit, while the broached box offers a long bearing surface that eliminates grooving of the brush. The punched steel lever is rigid and maintains its relation to the brush irrespective of wear. Tension is obtained by a steel wire spring, the design allowing a wide range of adjustment for brush pressure. A metal cap riveted to the brush avoids wear at the point of contact with the spring lever. A flexible copper connection with ample contact surface is supplied for carrying the current to avoid deterioration of the brush-holder spring.

Connection blocks are bolted to the under side of the magnet frame. To these are fastened the machine leads, which are fitted with suitable terminals for receiving the line cables.

While commutating pole generators are superior to non-commutating pole generators for any character of service, these machines with their many additional improvements in design will operate in a thoroughly satisfactory and reliable manner under the most severe service conditions, where fluctuating motor loads frequently predominate, such as for lighting and power service in office buildings, industrial plants, mines, etc.

Hints on Practice

Simple Sidewalk Construction *

The following is a true description of the situation to be found on many prosperous farms: "A comfortable and well built house, tastefully furnished. A wide porch affording protection from sun and rain. Substantial barn and outbuildings. Between these buildings run the pathways or walks used many times each day, but on hundreds of farms they are simply thoroughfares of mud during frequent periods, but especially in the spring, when the frost is coming out. they are a false and discordant note in an otherwise attractive environment."

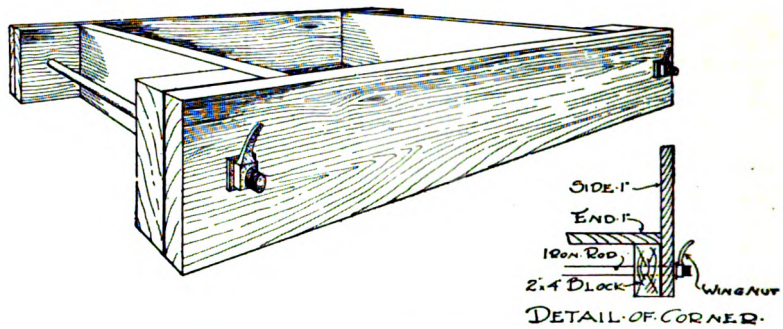
Now, the farmer who fails to establish good walks about his premises can no longer plead prohibitive cost or lack of time, and this is the season for him to remedy the situation. It is the purpose to set forth briefly a method of doing this at minimum outlay and by means so easy that it will seem like play to have a substantial walk from building to building, or from the house to the garden—something an intelligent boy of mechanical bent could accomplish.

To put down a concrete walk such as is common in towns and cities involves more or less experience, and requires time and money, though it would be a good investment if well done. Such walks are far cheaper in the end than any other continuous type equally satisfactory and durable. It so happens, however, that many farmers cannot conveniently undertake the construction of a long walk with the certainty that work will not be interrupted, and walks of this character should be a continuous operation if the most economical results are to be obtained. If the farmer can afford to employ an experienced contractor to do the work, well and good. If not, he should go about it in another way.

Some years ago a firm of enterprising young men engaged in general contracting in a Pennsylvania town of three or four thousand inhabitants. They noticed that all the little-used streets had board sidewalks. These were constantly rotting away or the ends of the boards would become loose and dangerous, warping with exposure and presenting an obstruction to pedestrians. Numerous complaints and frequent threats of suits for damages were filed with the town council at each meeting of that august body. Noting this, the young contractors decided that a good opening for increased business was at hand. They did not interfere with the professional sidewalk makers. They simply began the manufacture of concrete slabs and made it a profitable business. A farmer can follow the same plan. The method would be to make a few shallow boxes, each about 3 ft. long, 2 ft. wide, and 4 or 5 in. deep. Then make a concrete composed of 1 part portland cement, 2 parts clean sand, and 4 parts gravel or crushed stone, the stone not larger than ¾ in. To make the concrete, first thoroughly mix the cement and sand in the dry state and then add the water. The stone should also be wet and the whole mass mixed together until of mushy consistence—a consistence that would be called 'sloppy.' Dump the concrete into the boxes to the depth of

*From data furnished by Santa Cruz Portland Cement Co., San Francisco.

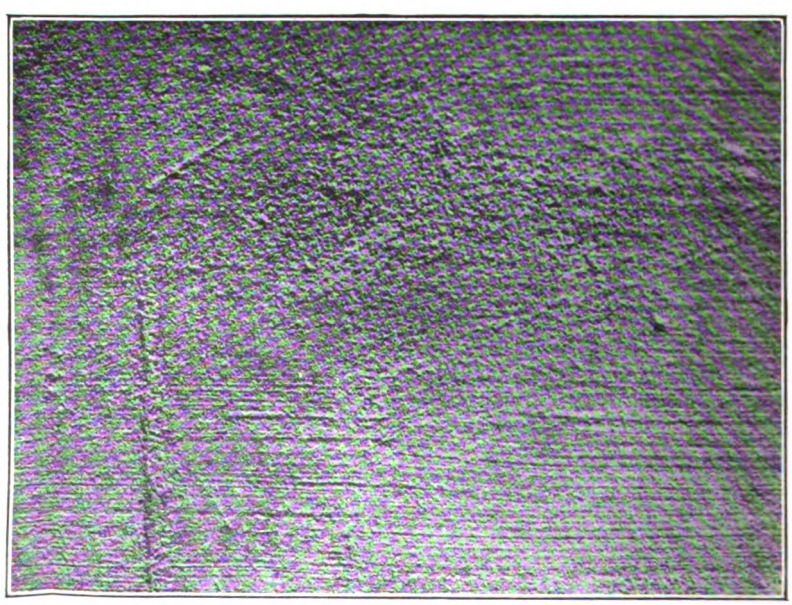
Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



A SIMPLE AND CONVENIENT BOARD FORM FOR CASTING SLABS.

an inch or more, puddle and work it, and then on top of this first layer of concrete place common chicken wire cut to the size of the box. Then fill the box with concrete and just before the latter has taken its final set the surface may be broomed with a circular sweeping motion to give a texture that will prevent people from slipping. The concrete may be removed from the forms or boxes in four or five days and protected from sun, wind, and freezing, as the case may be, and thereafter sprinkled daily for about a week. The result will be a fine slab of indestructible artificial stone.

Modern sidewalk practice does not always include a drained sub-base, as many suppose, but on the contrary many sidewalks put down in the customary way have been successfully built by placing them directly on a compact earth surface. The farmer can lay slabs on a natural base where the soil is at all suitable. This plan means that he may make just as few or as many slabs as he has time to make, once he has procured the raw materials. He could soon fill a half-dozen 3-ft. molds and thus have 18 ft. of walk in the forms, which could be refilled the moment the first lot was removed, or at any convenient time. In brief, he would be making so much concrete lumber, which could be distributed quickly and easily, in fact in less time than would be required to put down a well made board walk.



TWO BY THREE-FOOT CONCRETE SLAB SUITABLE FOR FARM WALKS.

Generated on 2024-09-30 00:35 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

In making his walks, the farmer need not confine the dimensions of the slab to those given above. If he prefers a longer and wider slab, it can easily be made. The first illustration shows the surface texture of a concrete slab of the above dimensions, and the second is a drawing of a simple type of form in which slabs may be conveniently cast.

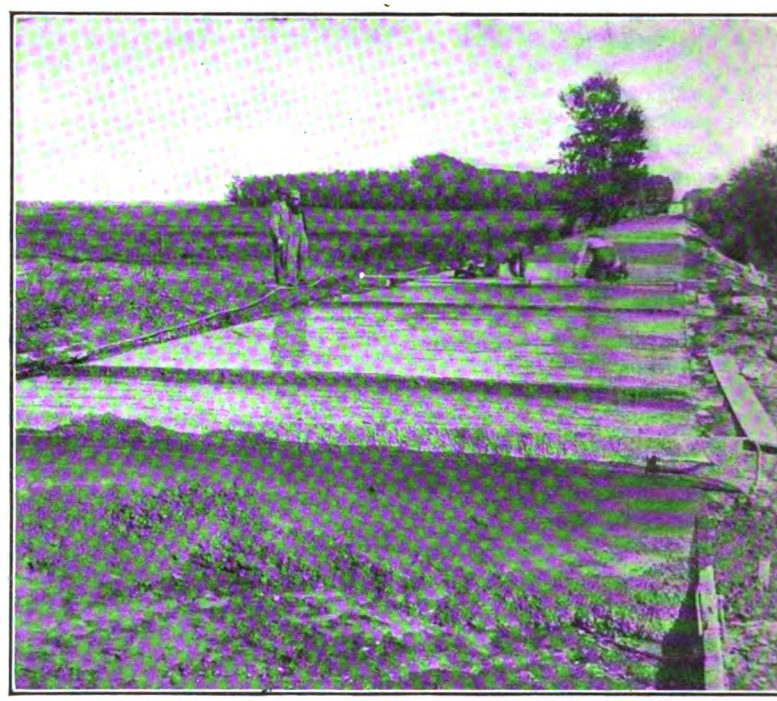
Concrete walks of this character would not only last for all time, but could be conveniently changed to other locations or extended without the necessity of digging and filling a foundation, erecting side forms, or cutting joints. Like the concrete road, which has become a veritable boon to every farming community fortunate enough to be in touch with one, the slab walk could of itself accumulate neither mud nor dust, would grow stronger with age and exposure, and contribute immensely to the comfort and convenience of its users.

The Farmer and the Road Problem*

IN Eastern Pennsylvania certain portions of that historic highway known as 'Old York Road' are still controlled by turnpike companies, and the tollgate continues to be a respected institution. A company controlling about two miles of this old road, over which Washington and the continental army marched at various times, has had a profitable investment, paying from 7 to 8% dividends. In by-gone days another section of turnpike leading into Old York Road paid its owners as high as 12%. Good stone and gravel pits made the maintenance of this road comparatively easy, and the much-talked-about patrol system was established many years ago. Always there were men at work cracking stone by hand and putting it into such depressions and washouts as occurred. But in spite of its solid bed and constant supervision, the road is going to pieces, as does the average road when subjected to automobile traffic. The rapidly revolving tires disperse the rock-dust or binding material in clouds, and the stones, upon exposure, are ripped out and hurled aside. The situation is akin to that in every rural community, and the turnpike company and farmers who dwell along this old turnpike are up against a problem. They must decide whether they will submit to bad roads, pay excessive annual maintenance charges or pay for a road so solid that it will never get out of repair. In many localities farmers have dismissed the first two propositions as impossible and they are building durable roads. And some of them believe it is better to do this by local taxation rather than to have the state take over and control the roads, thus depriving them of the right to say what type of road shall be built. It was the farmers who defeated the recently proposed $50,000,000 bond issue in Pennsylvania. They wanted the opportunity to build roads that would not be utterly destroyed long before state or county bonds should mature. In Connecticut, Maryland, New Jersey, New York, Delaware, and Pennsylvania, both state and local communities are turning to the concrete road as the solution of their problem and with excellent results. Taking a 16-ft. concrete road as a basis, highways of this character have cost on the average about $12,000 per mile, while maintenance costs have been practically nothing. For example, in Bellefontaine, Ohio, a concrete road put down twenty years ago has cost less than $25 per mile per year for maintenance, while the average maintenance cost of macadam roads in five eastern states in 1912 exceeded $800 per mile per year. The farmer, in adopting concrete, has figured the matter in this way; a road is an investment. The most conservative estimate of maintenance cost on macadam per mile per year would be certain to reach $300 if the road is subject to motor-driven traffic and kept passable at all seasons. An equally conservative estimate for construction is $6000 per mile. The $300 maintenance cost represents interest on $6000 at 5%, thus making the real investment $12,000 per mile, or the cost of a mile of indestructible concrete road. As a matter of fact, taking New York, New Jersey, and Pennsylvania costs, the investment would be some $25,000 per mile. From considering a single mile of roadway, it became interesting to figure costs on many miles, to see what would happen in the case of macadam as compared with concrete. For example, let it be assumed that 500 miles are to be built during a period of five years at the rate of 100 miles per year, and that repairs will not be required on either type of road for two years. Beginning, then, at the third year, and estimating maintenance costs for concrete at $25 per mile per year, the Bellefontaine figures, the total mainten-

*From data furnished by Santa Cruz Portland Cement Co., San Francisco.

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN



METHOD OF CONSTRUCTING A TYPICAL SIXTEEN-FOOT CONCRETE ROAD.

TWELVE-FOOT CONCRETE ROAD AT WHITEHALL, MARYLAND.

ance costs on 500 miles of concrete road would at the expiration of seven years, be only $37,500. In the case of macadam, basing costs on New York and New Jersey figures for 1912, repair costs would reach the enormous total of $1,350,000. Where concrete roads are very narrow, say 9 ft. wide, and have a dirt road at the sides, they could be built for $7500 per mile. Maryland has built excellent concrete roads of standard width for a little less than $12,000 per mile.

It is upon the above economic basis that farmers are beginning to look at the road question.

But aside from moderate first cost and practically negligible maintenance costs, the

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

popularity of the concrete road is rapidly growing in rural communities due to the experience of those who have used it. For the farmer it is the ideal highway. Described briefly, the building of a concrete road consists of putting a wet and mushy mass of portland cement, sand, and stone in the centre of a highway, where it hardens into imperishable rock. The accompanying illustrations give a very good idea of the building of a road and its appearance when finished. The first picture shows the construction of a concrete road near Mason City, Iowa. The concrete has been placed between rigidly staked side forms. The road is then troweled with wooden floats. The view of the finished road in Maryland shows its admirable surface. This type of road appeals especially to the farmer and his family, because it provides them at all seasons with an excellent place to walk as well as a thoroughfare for vehicles. It is a fact that in Wayne county, Michigan, children go to and from school on roller skates over the wonderful concrete roads of that locality. Horses never slip or fall upon these roads and will draw twice or three times their accustomed load. In Wayne county one farmer has driven an unshod horse over the concrete roads for a long period of time without injury to the animal. It is needless to say torrential rains cannot wash through these roads. The water must go over or under them. Another especially good feature of the concrete road is its freedom from dust as well as mud. Wherever farmers have used these roads they are enthusiastic in their commendation, not only because of their great durability and low maintenance cost, but because in every sense they represent the ideal highway and, therefore, the solution of the road problem as it applies to rural communities.

Engineering News

Petroleum

The Standard Oil Co. has announced a general reduction of the price of crude oil of 21 gravity and lighter of 5c. per barrel applicable to all fields. At the same time a corresponding reduction of ½c. per gallon in the sale price of gasoline and engine distillate has been announced. This is due to the greatly increased production in the California fields of the lighter oil. The following shows how the average gravity has changed within the last two years:

	Under 20°.	Over 20°.	Total.
January 1912	4,563,050	3,064,208	7,627,258
April 1914	3,487,320	5,053,718	8,541,038

The following are the old and new prices for the Coalinga and Midway fields, the same relationship prevailing in other fields:

Gravity.	Old price.	New price.
21-23.9	$0.50	$0.45
24-26.9	0.55	0.50
27-28.9	0.60	0.55
29-30.9	0.70	0.65
31-32.9	0.75	0.70

The Standard Oil Co. gives a daily average production for the month of April for all fields of 284,701 bbl., total stock April 30 being given at 49,625,570 bbl.——The Fullerton Oil Co., at Brea, has replaced its engines on wells No. 5 and 6 with Westinghouse special oil well motors.

San Francisco, Cal.—Dividends paid by California oil companies for the month of April were as follows:

Company.	Amount.
Associated	$600,000.00
Producers' Transportation	105,000.00
North American Con.	87,890.00
Amalgamated	62,500.00
Fullerton	60,000.00
American Petroleum (regular)	52,057.83
do, extra	28,868.00
Columbia Oil Producing	51,283.46
Sterling Oil & Dev.	25,000.00
Peerless	25,000.00
Caribou	16,140.60
West Coast	15,612.00
Coalinga Mohawk	10,000.00
Kern River	10,000.00
Montebello	10,000.00
Section Twenty-five	10,000.00
Western Union	10,000.00
Pinal-Dome	9,000.00
S. F. & McKittrick	4,995.00
Mt. Diablo O. M. & D.	4,674.85
Rice Ranch	3,000.00
Mascot	3,000.00
Sauer Dough	2,992.50
State Consolidated	2,000.00
Home (Whittier)	500.00
Total	$1,209,334.24

California field operations and production

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

for the month of April 1914, according to the *Oil Age*, were as follows:

Field.	Rigs completed during month.	Wells — Drilling.	Wells — Completed during month.	Wells — Abandoned during month.	Wells — Producing.	Production for month.
Kern River	..	6	1	1	1207	605,744
McKittrick	..	3	..	..	265	283,646
Midway-Sunset	23	91	18	2	1305	4,204,818
Lost Hills-Belridge	2	16	7	1	227	417,087
Coalinga	..	27	..	9	862	1,312,738
Lompoc-Santa Maria	..	11	..	..	241	467,396
Ventura County-Newhall	2	29	1	..	408	81,565
Los Angeles-Salt Lake	..	6	1	2	697	210,015
Whittier-Fullerton	1	72	5	2	510	1,081,063
Summerland	..	..	..	..	125	4,950
Total	28	261	33	17	5847	8,669,022

Streets and Roads

Sausalito, Cal.—A bond issue of $100,000 to provide funds for new streets and roads has been approved by the voters.

Oakland, Cal.—E. J. Henderson of this city will expend approximately $100,000 for street work in the Havenscourt tract.

San Francisco, Cal.—The Board of Public Works has placed a contract with Eaton & Smith for the construction of the Potrero avenue municipal railway line for $143,767.80.

Sacramento, Cal.—Bids were opened by the State Highway Commission for various sections of the State Highway as follows:

Santa Clara county, Gilroy to Sargent, 6 miles of portland cement concrete, H. L. Peterson and A. J. Grier, San Francisco, $40,887.50; Fred Leffler, San Francisco, $57,865. State Engineer's estimate $40,223, plus $27,833.50 in materials furnished by the State.

Solano county, Benicia toward Cordelia, 9 miles, cement concrete, Commery Peterson Company, San Francisco, $56,410. State Engineer's estimate on construction cost $57,215, plus $45,668.31 in materials furnished by the State.

Kern county, Bakersfield north for 13 miles, cement concrete, Roger Brothers, Los Angeles, $79,386.50; Richard Rothwell, $94,798; John D. Marsh, Los Angeles, $72,282.70; Lynn Atkinson, $87,227.50; State Engineer's estimate $76,796.25, plus $67,912.50 in materials to be furnished by State.

Marin county, Larkspur to Sausalito, 6 miles graded gravel, H. L. Peterson and A. J. Grier, San Francisco, $71,597; Percy L. Burr, San Francisco, $70,765.50; O'Brien Brothers, Oakland, $53,395; P. H. Hoare, Oakland, $64,374.50; State Engineer's estimate, $60,776.25, plus $11,368.10 cost of materials to be furnished by State.

Solano county, Fairfield to Vacaville, 8.8 miles, cement concrete, Commery Peterson Company, San Francisco, $49,571.70; State Engineer's estimate, $61,702.12, plus $39,292.60 cost of material to be furnished by State.

Tulare county, Tulare to Tagus Siding, 4.3 miles cement concrete, Parlieu Hezden Company, Tulare, $21,861.90; State Engineer's estimate, $19,549.43, plus $21,006.90, cost of material to be furnished by State.

Colusa county, Hirshey to Berlin, 10.8 miles, cement concrete, M. Blumenkranz, Stockton, $59,991.50; C. L. Shaad, Williams, $54,905.50.

Los Angeles county, Liebre Mountain to northerly county boundary, 12.7 miles cement concrete, C. H. Hudson, Los Angeles, $188,409.20; Lee Moore, Caliente, $153,019.10; P. A. and C. H. Howard, Los Angeles, $180,075.80; Richard Rothwell, Los Angeles, $290,889; W. W. Atkinson, Los Angeles, $189,099; Leigh G. Garnsey, Los Angeles, $237,295.29; State Engineer's estimate, $202,366.81, plus $44,306.90, cost of material to be furnished by State.

Humboldt county, Dyerville to Shively, 7.3 miles, A. C. McLean Construction Company, Fort Seward, $83,163.80; Frank L. Smith, Eureka, $67,365.30; P. L. Burr, San

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

Francisco, $71,329.50; Fairbanks & Baechtel, Willits, $82,079; William Crowley and Thomas E. Cloney, Eureka, $66,611.40.

Bids will be opened by the State Highway Commission on June 8 for sections of the State Highway as follows: Shasta county from La Moine to Hazel Creek P. O. about 9.9 miles in length, to be graded. Tehama county from the southerly boundary to Corning, about 8.8 miles in length, to be built of portland cement concrete. Butte county from Lindo channel to the northerly boundary, about 11.2 miles in length, to be built of portland cement concrete. Glenn county from Grapit to the northerly boundary, about 7 miles in length, to be built of portland cement concrete.

Santa Rosa, Cal.—The Sonoma county Board of Supervisors is considering calling a special election within 90 days to vote upon a bond issue to provide funds for the construction of additional good roads throughout the county.

Placerville, Cal.—Work will commence within a few days upon that portion of the State Highway between El Dorado and the Webber Creek bridge. Bids will be called for on an 8-mile section between Shingle and Clarksville and also for a 5-mile strip between White Rock and Folsom.

Ogden, Utah.—Paving work for the coming season for which plans have been approved will cost approximately $62,000. Chris Flygare is commissioner of streets.——Washington Jenkins, city engineer, is planning the construction of a river boulevard on each side of the Ogden river from the western limits of the city to the mouth of Ogden cañon.

Salt Lake City, Utah.—The general Forest Service has appropriated $3600 for the construction of a wagon road between Kansas and Stockmore, points in the Uintah basin. Bids received for the Thirteenth East and Third avenue paving extensions show that bitulithic pavement cost less in each case than rock asphalt. The prices for bitulithic range from $2.12 per sq. yd. to $2.25 as against bids of $2.25 to $2.39 on rock asphalt previously opened.——E. R. Morgan, state road engineer, has decided to use traction engines and graders on all state road work instead of the old style horse team method. It is estimated that this change will save about one-half the cost of road building by the old style.——G. A. Gilkerson was given the contract for laying curbs and gutters in the territory from Eleventh East street to Mt. Olivet cemetery, and from Third to Ninth South streets, on a bid of $68,442.63, which was about $12,000 less than the city engineer's estimate. G. A. Heman was given the contract for building cement sidewalks in the territory west of Jordan river and between First and Fifth South streets on a bid of $17,347.40.

Spokane, Wash.—The Adams County Commissioners have let a contract to A. S. Zane & Co. of Hanford for the construction of 7 1-3 miles of highway from Ritzville, completing the link in the Trunk road to Ralston. The roadway will be 22 ft. wide and the Board of County Commissioners had decided to macadamize 7 miles of road connecting Meadow lake with the Sunset boulevard.

Power, Gas, and Electricity

Spokane, Wash.—The Washington Water Power Co. has effected an agreement with the City Council of Spokane fixing lighting rates as per the following schedule:

Present rates per kilowatt:

First 20 kilowatt hours	10c.
Next 20 kilowatt hours	9c.
Next 20 kilowatt hours	8c.
All over 60 kilowatt hours	5c.
Cooking rate, separate meter	5c.

New rates to take effect July 1, 1914:

First 20 kilowatt hours	8c.
Next 10 kilowatt hours	6c.
All over 30 kilowatt hours	3c.

Proposed rates to take effect July 1, 1916:

First 20 kilowatt hours	7c.
All over 20 kilowatt hours	3c.

Minimum charge $1 in old and 70c. in new rates.

San Francisco, Cal.—The San Francisco-Oakland Terminal Railways have applied to the Railroad Commission for permission to issue $10,000,000 in bonds to provide funds for various improvements in its system. New cars and two additional ferry boats are to be built and the new Key Route pier is to be completed.——The San Joaquin Light & Power Corporation has called for a special meeting of stockholders to be held on June 11 for the purpose of authorizing a change of $3,500,000 of unissued preferred stock into 6% cumulative prior preferred stock, which will have pre-

Generated on 2024-09-30 00:40 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

ference over the existing preferred and common stock, both in respect to payment of dividends and principal. The funds to be provided by this means are to be applied for liquidating a portion of the existing floating debt and also for providing a working capital fund for improvements and betterments.

Los Angeles, Cal.—By a vote of the people on May 8, the city of Los Angeles provided for a bond ssue of $6,500,000 for the purpose of constructing a municipal electric light and power plant, acquiring distributing lines, conduits, sub-stations, etc.

Miscellaneous Engineering Construction

San Francisco, Cal.—The construction of two bridges to be built jointly by San Joaquin and Contra Costa counties under the auspices of the U. S. War Department is contemplated. One bridge is to be constructed across Middle river in the vicinity of Trapper slough and Victoria canal, and the other across Old river at the western limit of Victoria island near Stockton. Major S. A. Cheney of the U. S. Engineer Corps has the matter in hand.——The Board of State Harbor Commissioners has approved plans and specifications for pier 35 to be built at the foot of Montgomery street. The new pier is to be 200 ft. wide, 817 ft. long on the northerly side and 975 ft. long on the southerly side. The pier will be supported on reinforced concrete piles and a reinforced concrete deck. The Healy Tibbetts Construction Co. has been directed to commence work upon the car ferry slips at the foot of Taylor street and the San Francisco Bridge Co. to commence work upon the construction of pier 41 at the foot of Mason street.——Contract for the construction of pier 15 to be built at the foot of Green street has been awarded to the San Francisco Bridge Co. by the State Harbor Board at the price of $73,000. ——Specifications have been issued for two steel propeller ferry boats to be built for the San Francisco-Oakland Terminal Railways. John H. Hopps, consulting engineer of San Francisco, designed the boats and the estimated cost is approximately $200,000 each.

Sacramento, Cal.—The California Highway Commission, Forum building, Sacramento, has called for bids for a reinforced concrete and timber trestle in Yolo county across the Yolo by-pass about three miles in length. Bids will be opened on June 8.

Gridley, Cal.—G. W. Tolley has contracted with the Standard Oil Co. for the construction of a new oil distributing plant at this point. The project includes construction of three steel oil tanks, barns, office building, wagon sheds, etc.

Red Bluff, Cal.—The city is considering a bond issue to provide funds for street paving and new sewers.

Marysville, Cal.—Bids have been received by the Board of Supervisors for boring test holes to determine foundations for the proposed new concrete bridge which is to be built at a cost of $130,000. A. E. Jens bid $1.35 per foot and Luke O'Brien $2 per foot. Proposed plans for the bridge have been filed by the Commonwealth Engineering Co. of Portland, Ore., and by the Ind Engineering Co. of Los Angeles.

Railways

San Francisco, Cal.—The Trona Railway Co., a subsidiary corporation of the American Trona Corporation, has filed an application with the Railroad Commission for permission to issue first mortgage bonds in the sum of $250,000. The proceeds of this bond issue are to be applied for the purpose of constructing a standard gauge railroad between the properties of the American Trona Corporation at Searles lake in San Bernardino county and the Owenyo branch of the Southern Pacific Co., a distance of 31 miles. The American Trona Corporation is now constructing a chemical plant at Searles lake for the reduction of chemical salts for commercial purposes. It is estimated that the plant will reduce 2,000,000 gallons of brine per day and produce therefrom 1252 tons of potassium chloride, borax, and carbonate of soda; 1507 tons of table salt, and 593 tons of sodium sulphate.

Butte, Montana.—The Butte, Boise & San Francisco Railway Co. has been incorporated with an authorized capital stock of $125,000,000. These are amended articles of incorporation for the Butte, Boise & Winnemucca road filed 6 months ago. The route of the new road extends from Butte to Jordan valley, thence by way of Steen mountain to the northeast corner of California through Surprise valley and from that point along

Generated on 2024-09-30 00:34 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

the line of the Pit river, Sacramento river, via Woodland, Napa Junction, and San Rafael to Sausalito.

Irrigation and Water Supply

Fresno, Cal.—The county Board of Supervisors has granted the petition of the San Joaquin Valley Farm Lands Co. for the formation of a reclamation district on the east side which will include about 12,000 acres. An election for trustees of the district will be held on June 12.

Sacramento, Cal.—The reclamation board has approved plans for Lovelace district No. 739 near Tulare lake and for the Mull district No. 1600 in Yolo county. The latter provide for a width of by-pass at the upper end of 7600 ft. and stipulate that the construction of the levee must be done under the direction of the State Flood Control Engineer. Plans for supplementary work on district 108 have also been approved. A petition has been received and taken under advisement on behalf of district 1500, the Sutter Basin project, asking that the board order the construction of the east levee of the Sutter Basin by-pass.

Redding, Cal.—Petition has been received by the Board of Supervisors from 263 land owners with reference to the formation of the Anderson Irrigation district. The petition asks that 27,000 acres of land be thrown into an irrigation district to be served with water from the Sacramento river at Turtle bay.

Tehama, Cal.—Plans are being prepared for a new municipal water system. Mr. Luning is county surveyor in charge of the project. A well is to be sunk adjacent to the present pumping plant and 21 fire hydrants are to be provided. The total cost is estimated at $10,000.

Salt Lake City, Utah.—The City Commissioners have decided to expend $250,000 this year for enlarging and improving the city water system. These funds are to be derived from the sale of a portion of the water and sewer bond issues authorized in February last.——The city engineer has completed plans for the Twin Lakes reservoir dam in Big Cottonwood cañon where 300,000,000 gallons of flood water will be stored. The estimated cost is $70,000.—Plans have been completed for the fifth east distributing reservoir to be built at a cost of $33,000.——Plans have been approved by the Commission for the thirteenth south supply main to be built at a cost of $110,000.——Preliminary work on the Parley cañon reservoir is under way.——It is proposed to build a reservoir in City Creek cañon for storing 800,000 gallons of water at an estimated cost of $22,000.——It has been announced that Owen Gray & Co., contractors for the Lakes Mary-Phoebe dams above Brighton, will resume work early in June.——The city will use cast iron pipe at a cost of $110,000 for a main supply from Big Cottonwood along Thirteenth South street to the city.

Personal

G. A. STRAND is city engineer at Eureka, California.

B. K. STROUD, petroleum engineer, of San Francisco, has returned from a trip to Nevada on professional business.

JOHN D. MORTON has been appointed district manager at Phoenix, Arizona, for the Barber Asphalt Paving Company.

P. N. NORBOE, assistant state engineer for California, has been in Washington, D. C., in behalf of the Feather River improvements.

L. E. HANCHETT of San Francisco has been elected chairman of the Northern Electric Co. executive committee, succeeding PERCY T. MORGAN.

ELWOOD MEAD, irrigation engineer, delivered an address on 'Land Settlement' before the Commonwealth Club of California on the evening of May 8.

J. W. FRENCH has been appointed California branch manager for the Austin Western Road Machinery Co., with headquarters at 22 Fremont street, San Francisco.

CARLTON R. ROSE has resigned his position as superintendent for the U. S. Zinc Co. at Pueblo, Colorado, to become an associate of Smith, Emery & Co., chemical engineers.

DAVID DORWARD, JR., formerly manager for the General Pipe-Line Co., has joined the engineering staff of Sanderson & Porter, with offices in the Nevada Bank building.

C. C. HARRIS has resigned his position as general manager for the C. C. Harris Oil Co., operating in the old Los Angeles field, in order to devote his time to private enterprises.

FRANK ADAMS, irrigation engineer for the U. S. Department of Agriculture, recently delivered a lecture at Fairoaks, California,

Generated on 2024-09-30 00:39 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN

under the auspices of the Fairoaks Growers' Association.

R. L. THOMAS, formerly city engineer at Eureka, California, has joined the engineering staff of San Mateo county with special reference to the construction of the new roads about to be undertaken.

G. W. MORRIS, inspector for the U. S. Bureau of Public Roads, has been on an inspection trip over the trans-mountain highway from Stonyford at the Glenn-Colusa county line to Upper Lake, California.

EMORY OLIVER, formerly chief engineer for Natomas Consolidated has been appointed general manager for the Company, succeeding S. L. G. KNOX, who has resigned his position to engage in private practice.

JOHN F. ELLISON has been elected president; W. A. BEARD, first vice-president; DAVID BROWN, second vice-president; A. L. CONRAD, secretary; and T. H. RAMSAY, treasurer for the Iron Canyon Project Association, with headquarters at Red Bluff, California.

ARTHUR P. DAVIS, chief engineer for the U. S. Reclamation Service, has been granted a leave of absence by the Secretary of the Interior to become a member of the board of engineers which the Red Cross Society is sending to China for the consideration of sanitary matters.

WILLIAM C. EDES, chief engineer for the Northwestern Pacific Railway, has been appointed by President Wilson as a member of the Alaskan Engineering Commission, which will have charge of the location of railroads in Alaska under the recently enacted Alaskan railroad act.

CHARLES N. BOYNTON, chief engineer for the Universal Portland Cement Co., and H. L. DOYLE, general manager for the reinforced concrete department of the American Steel & Wire Co., are interested in the newly organized Sonoma Magnesite Co., which is about to commence the erection of a large plant for the production of magnesite in Sonoma county.

PREVOST HUBBARD, of the Institute of Industrial Research, Washington, D. C. and ARTHUR H. BLANCHARD, professor of highway engineering at Columbia University, have been elected by the council of the International Association for Testing Materials as the American members of Commission No. 58 on 'Standardization of Methods of Testing and Nomenclature of Road and Paving Materials.'

FORD, BACON & DAVIS, consulting engineers of New York and San Francisco, have been retained by the state of Louisiana to undertake the design and construction of a new model warehouse in New Orleans for the storage of cotton. This warehouse will be the largest in the world. It will have a storage capacity of 1,000,000 bales and cover 140 acres. In this connection a terminal railroad is to be built that will be able to handle 900 cars a day. Modern conveying machinery will also be installed to facilitate the transfer of the bales from cars to warehouse and from warehouse to steamer.

Catalogues Received

THE PITOMETER CO., 220 Broadway, New York. Leaflet illustrating, describing, and showing the application of the Cole Pitometer system.

PAWLING & HARNISCHFEGER CO., Milwaukee, Wisconsin. Catalogue of the P. & H. excavator. This device is one more instance of the ever increasing substitution of machine for hand labor. It is essentially a trenching machine and is self-propelling, with either wheel or caterpillar tractors as desired. The design and construction show a marked simplicity and rigidity with exceptional ease of control. A guarantee is given of 3 lineal feet per minute in a trench 3 feet deep in ordinary earth that can be dug with a spade and is free from boulders, shale rock, or other serious obstructions.

GENERAL ELECTRIC CO., Schenectady, New York. Bulletin A4139, 'Central Station Oil Switches of High Rupturing Capacity.' Bulletin A4135, 'The Lightning Arresters for Electric Railways.' Bulletin A4093, 'Generator for Electrolytic Work.' Bulletin 4972, 'KR System of Voltage Regulations.' Bulletin A4115, 'Electricity on the Farm.' This is an exceptionally attractive publication and devoted especially to the many applications of electricity to the needs of the farming and rural districts. Much valuable engineering data are also given with respect to the comparative costs of irrigation by various methods, quantity of water required, weir tables, frictional losses of the transmission of water in pipes, etc. Bulletin A4142, 'Importance of Operating Lamps at the Proper Efficiency.' Bulletin A4137, 'Curtis Steam Turbines from 100 to 2500-kw. Capacity.'

Generated on 2024-09-30 00:32 GMT / https://hdl.handle.net/2027/uiug.30112007838003
Public Domain, Google-digitized / http://www.hathitrust.org/access_use#pd-google
Digitized by Google
Original from UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN